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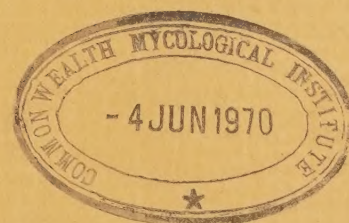


ANNUAL REPORT

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DEPARTMENT OF AGRICULTURE
NEW SOUTH WALES

1969

PARLIAMENT OF NEW SOUTH WALES

REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE
Year ended 30 June, 1969

Ordered to be printed, 21 October, 1969

BY AUTHORITY

V. C. N. BLIGHT, GOVERNMENT PRINTER, NEW SOUTH WALES—1970

REPORT

STATEMENT OF ACCOUNTS

FOR THE YEAR 1900

AND FOR THE MONTHS JANUARY TO DECEMBER

Prepared by the Board of Directors
and presented to the Shareholders at the Annual Meeting held on January 10, 1901

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ADMINISTRATIVE AND SENIOR EXECUTIVE PERSONNEL *

As at 30th June, 1969

Minister	Hon. G. R. CRAWFORD, M.L.A.
Director-General	R. M. WATTS
Deputy Director-General (R.E.)	D. F. C. BUTLER
Deputy Director-General (P.T.)	B. OWEN FRENCH
Secretary	J. L. HAGER
Accountant	K. A. RUSSELL

Chiefs of Divisions:

Animal Industry Division	R. A. HALL
Dairy Division	D. W. CROWFOOT
Horticulture Division	R. G. KEBBY
Plant Industry Division	A. C. ORMAN
Science Services Division	T. H. JOHNS
Marketing and Agricultural Economics Division	C. J. KING
Information Services Division	H. PARRY BROWN
Extension Services Division	B. D. AMENT
Chief, Research Stations Branch	N. K. GOLDING

Principals, Major Agricultural Colleges:

Hawkesbury Agricultural College	B. DOMAN
Wagga Agricultural College	B. F. ATKINS

Royal Botanic Gardens and National Herbarium:

Director and Chief Botanist	N. K. MAIR
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* For more detail of staff of the various Divisions, Branches, Institutions, Regions, etc., see the Department's brochure *Directory of Officers*. For staff numbers see *Appendix III* of this Report.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister for the Year ended 30th June, 1969

Department of Agriculture, Sydney, 30th September, 1969.

Dear Sir,

Herewith the Report of the Department of Agriculture for the 12 months ended 30th June, 1969.

Yours faithfully,

R. M. WATTS, Director-General.

NOTES FROM CENTRAL ADMINISTRATION

Notes on the Seasons

In July, 1968, at the outset of the 12 months under review, the outlook in many areas was acceptable if not favourable. In others the drought conditions were already critical and destined to continue so for several months into the new fiscal year. By summer, most areas had notably deteriorated. Then came an autumn break in the prevailing weather pattern and, virtually onwards from mid-February, 1969, the growing conditions in most areas were much improved.

A major exception to the acceptable pastoral outlook in July, 1968 was the drought afflicted southeastern corner. There were others. As a result the Government's drought emergency measures were extended. Direct financial help was in the form of subsidies for transport of fodder and of stock—to and from agistment and for restocking.

There were helpful rains for much but not all of the State during the 1968 winter, but in the spring months almost all districts deteriorated. A frosty dry September and the below average rains and the strong drying winds in October were responsible.

By the start of the 1968–69 summer most coastal areas were poorly. In particular the south coast was still drought stricken. This sector had had no recovery period. Some inland northern areas were also in poor condition.

Bushfires too were extensive in many coastal and adjacent tableland areas. Late October and early November were notable bushfire periods and in some localities their damage was severe.

Rains in December, 1968 brought improvement. On the north and central coasts fodder crops benefited even though—because of the previously dried out soils and the lack of follow up rains—the pasture response was at best only moderate. The south coast also responded to some extent. Inland by this time the situation was better—with a good cover of dry feed, good grazing on stubbles, and some green feed in most areas. Less well off for feed were some tableland and far western areas.

After the December rains and until mid-February the weather was hot, and there were frequent heatwaves in the Western Division in January. Pastures and non-irrigated summer crops made little headway in these conditions. Most coastal areas redeteriorated. Many northern inland localities again faced drought or near drought conditions. Supplementary feeding was increasingly needed.

A dramatic widespread reversal of the adverse trend came in late February and early March, 1969. Regular good falls of rain and satisfactory growing conditions proceeded to generate extensive pasture and fodder crop growth in most districts. Thus was provided a good foundation whereon to face the coming cooler months.

Some of the northern districts—along the Queensland border—had not received this much needed boost. Parts of the Monaro and far south coast had not yet returned to normal either. Handfeeding had become more widespread in these parts.

April temperatures were mainly high but May, as would be expected, was mainly cooler. In fact, cold and windy conditions had spread over most of the State by the end of May. Then conditions moderated in June—prevailing mild to cool weather.

That final quarter of the 12 months was marked by widespread and fairly frequent rain—heavy at times. Best falls were in April and May. June rainfall on the north coast and inland was in fact below normal.

The frequent rains in autumn seriously waterlogged many central and southern soils, and hindered the pastoral and farming operations there. Overall, however, the moderate climatic conditions in this final quarter, with the rainfalls, induced a very satisfactory pastoral outlook in most districts. Generally, plant growth has been better than is usual at this time of the year. In fact most inland, central, southern and western areas have had their best autumn for ten or more years past.

At the end of June, 1969, there was a surplus of pasture growth in most districts. Consequently, sown and self-sown grazing crops were not utilized to the usual extent or could not be kept in check by the stock available. Exceptions to the lush conditions were some northern parts of the Western Division, and northern tableland and unimproved north coast areas. These had received insufficient rain to offset the effects of the previous month's droughty conditions.

A notable feature of the months from March to June inclusive was the considerable movement of stock from Queensland drought areas to interstate or local sales or agistment.

Concerning wheat: at the end of March it appeared that growers in most districts planned to sow a 1969 area that would in aggregate equal or better the record 1968 sowing of 10,173,000 acres. But the heavy autumn rains disrupted these intentions, in the central and southern parts of the wheat belt in particular, and some of the prepared land could not be sown.

The Department has estimated that the 1969 wheat sowings aggregated 9,500,000 acres. Although the wet conditions had an adverse effect the State's wheat crop prospects were generally good to very good at the close of June—though a spell of fine weather was needed.

A record crop was in prospect but the forward growth of early sown crops suggested that many would be prone to heavy frost damage later in the season. If frosts were severe in winter and early spring these would markedly reduce the yield in advanced crops; especially northern and central.

The 1969 oat acreage was estimated by the Department at about 2,100,000 acres, similar to that in 1968. The barley area is believed to have increased this year to over 600,000 acres, compared with 550,000 acres in 1968. For oats and for barley the crop prospects were good to excellent at the end of June.

Notes on Commodity Production

CEREALS

Production of the major cereal crops reached high levels in 1968–69. Records were achieved by some of them.

Wheat—Record Production and Acreage

The 215,119,000 bushels of wheat produced easily exceeded the previous record—202,500,000 bushels achieved in 1966–67. The drought-affected 1967–68 season had produced only 87,300,000 bushels, from a record 8,200,000 acres sown for grain.

A record 10,173,000 acres was sown (9,959,000 for grain), considerably above the record 8,420,000 acres sown for all purposes in the previous year.

Yield average was 21.6 bushels per acre, compared with the drought-affected average of 10.6 bushels in 1967–68, still well below the 1966–67 record of 28.4 bushels per acre.

Oats

The oat grain harvest reached 27,315,000 bushels, the third from highest on record and well above the 1967–68 drought crop of 8,235,000 bushels. Yield average was 23.1 bushels per acre, considerably under the 1966–67 record of 30.1 bushels per acre, but naturally better than the 1967–68 season's 9.0 bushels per acre.

Area sown for all purposes was 2,125,700 acres (1,184,600 acres for grain). Comparative 1967-68 figures were 1,811,000 acres for all purposes (907,200 acres for grain).

Barley—Record Acreage and High Production

The area sown for all purposes totalled 548,400 acres (486,100 acres for grain), compared with 425,850 acres (367,500 acres for grain) in 1967-68.

Production was the second from best achieved, at 11,186,700 bushels (6,273,500 bushels of two-row and 4,913,200 of six-row). It was well above the drought-affected 4,834,000 bushels in 1967-68 and very close to the 1966-67 record of 11,796,000 bushels.

The yield average of 23.0 bushels per acre naturally bettered the previous season's 13.2 bushels per acre but was inferior to the 1966-67 record 30.6 bushels per acre.

Maize—A Big Acreage and Harvest

The 1969 maize grain harvest was estimated at 4,500,000 bushels. Some 1,500,000 bushels of this was produced on the rapidly expanding acreage under irrigation. It was the biggest harvest since 1923 and comparable in size with the crops of the 1903-1913 period.

The area sown for grain was estimated to be 76,000 acres, as against 67,600 acres in 1967-68.

Grain Sorghum—Record Production

A record of 5,600,000 bushels of grain sorghum was harvested in 1969. The 1967-68 harvest was 3,250,000 bushels.

Dryland sowings exceeded 105,000 acres, and the area under irrigation almost doubled—to 60,000 acres. Poor seasonal conditions reduced considerably the area that could be harvested. Output would otherwise have been well above what was achieved.

Rice—Record Production and Record Yield Acreage

Rice production approximated 250,500 tons from 82,690 acres sown. The previous record was 217,350 tons, from 75,870 acres, in 1967-68.

The yield average of 3.02 tons per acre is a world record. The previous record of 2.86 tons per acre was achieved here in each of the two previous seasons.

FIBRE AND OIL CROPS, ETC.

Cotton—Probable Record Production, from Record Acreage

Harvesting of cotton from the 60,780 acres sown was well advanced but not yet complete at the end of June. Due to adverse harvesting weather, production might not reach 130,000 bales but the standing records of 51,200 acres sown and 114,000 bales produced in 1967-68 seemed likely to be surpassed.

Tobacco—Increased Acreage

Tobacco plantings increased to an estimated 2,180 acres in the Ashford-Bonshaw-Yetman section of northern New South Wales. The previous season's plantings in this area totalled some 1,790 acres. Production is believed to be only a little below the State quota of 2,563,000 lb of leaf, at a yield average of about 1,150 lb per acre.

A further quota-increase is expected in the 1969-70 season, proportionate with the Commonwealth quota-increase from 28,500,000 lb to 31,000,000 lb.

Soybeans—Dramatic Acreage and Production Increases

The area sown to soybeans increased dramatically, from about 200 to almost 1,400 acres. Practically all was grown under irrigation. More than half the sown acreage was in the Dubbo district. Estimated production reached a record figure of 33,600 bushels; a yield average of over 24 bushels per acre.

Though still only a minor crop in this State, interest in soybean production is continuing to increase.

Linseed—A Trend to Increased Production

Linseed sowings in 1968-69 approximated 14,000 acres, compared with about 10,000 acres in 1967-68, but due to adverse seasonal conditions the yields did not reach the levels expected.

A very marked increase in acreage is expected next season, because of proposed introduction of wheat delivery quotas and also changes in linseed processors' requirements.

Safflower—Slump in Acreage and Production

The sown area in 1968-69 slumped to about 2,500 acres, as against the estimated 8,550 acres in 1967-68. Seasonal conditions were unfavourable for safflower and yields failed to reach anticipated levels.

Sunflowers—Record Acreage

Some 8,800 acres of sunflowers were sown in New South Wales in 1968-69; a record. But only a small area was under irrigation. The 1967-68 acreage was about 6,000 acres.

Irrigated crops yielded up to 1,680 lb per acre, whereas the State's yield average was about 540 lb per acre.

FRUIT AND ALLIED INDUSTRY

Citrus Fruits—Production Lower

The final estimate for 1968-69 was 6,940,000 bushels (comprising 6,710,000 bushels of main crop, plus 120,000 bushels of summer crop lemons and 110,000 bushels of second crop Valencia oranges). This was 520,000 bushels less than the record 1967-68 total of 7,460,000 bushels, due to seasonal conditions, and indications are that the 1969-70 crop will have been similarly affected.

Pome Fruits—Record Production

The 1968-69 apple crop and pear crop was each a record for New South Wales; 4,000,000 bushels of apples—as against 3,423,000 bushels in 1966-67 and 3,000,000 bushels in 1967-68; and 678,000 bushels of pears, compared with 619,000 in 1966-67 and 525,700 in 1967-68.

Pear production is thought unlikely to increase significantly in the foreseeable future. But, with 15 per cent of all apple trees under 5 years of age and with 25 to 30 per cent under 10 years, steadily expanding production of apples is expected.

Stone Fruit Production

Apricots and Peaches for Canning.—The MIA canning-apricot harvest of 6,000 tons was less than normal for an "on-crop" year but bettered by 1,400 tons the previous year's production. Crops there range from 4,400 to 9,400 tons per season.

The MIA canning-peach production, on cannery delivery figures, was only 15,850 tons whereas 20,000 tons had been expected—and 21,226 tons (only 58 tons less than the record) had been delivered in the preceding season. Losses this season through Rutherglen bug and brown rot were severe.

Prunes.—Estimates for 1968-69 were 1,170 tons from the MIA and 1,796 tons from Young—a total of 2,966 tons for N.S.W. The record tonnage was 5,316 in 1966-67. This 1968-69 crop was adversely affected firstly by a light setting and latterly by prevalent wet conditions at harvesting.

Banana Production and Acreage Lower

Banana consignments to all markets totalled 3,595,471 bushels, from 22,696 acres, as against the record 4,840,180 bushels from 23,469 acres in the previous year. There was not only the marked fall in production and in acreage, but also the notable drop in production per acre. The figures reflect the severe drought in the area, the bushfire losses, and the effect of following immediately the year of exceptionally high production—1967-68.

Wine Grapes and Wine Industry—Further Records

For the 1969 vintage the wine grapes production in N.S.W. has been estimated as 52,000 tons—exceeding the 1968 record of 49,536 tons. Similarly, wine production for the 1969 vintage is expected to total 9,000,000 gallons, as against the 8,349,774 gallons in 1968.

Dried Vine Fruits—Production Again Lower

The 1968-69 season's production in N.S.W. has been estimated as 7,800 tons (dried weight) as against 12,503 tons in 1967-68 and the record 14,951 tons in 1966-67. Australia-wide production has been drastically low—through adverse weather at critical stages and through increasing diversion of sultanas to wineries and the fresh fruit market. This has made difficult the supplying of current export markets.

MEAT PRODUCTION

Only preliminary figures are available as yet. These include the following:

Beef and Veal

Production of beef and veal approximated 217,520 tons, compared with 220,880 tons in 1967-68. It was the second lowest production total since 1960-61 and far below the record 1964-65 output of 303,420 tons.

Mutton and Lamb—Record Production

Production of mutton and lamb totalled a record 221,160 tons. The previous record was 203,170 tons, in 1967–68.

Pigmeats, and Bacon and Ham

Production of pigmeats, other than bacon and ham, continued to increase, with the 1968–69 output reaching a record 45,510 tons. The previous record, 41,130 tons, was in 1967–68.

Bacon and ham output totalled 14,750 tons, compared with 15,120 tons in 1967–68.

Poultry Meats—Expanding Production

Production of poultry meats continued to expand, but at far less than the big rate of increase noted in the preceding four seasons. Output totalled a record 51,690 tons, compared with 49,540 tons in 1967–68.

Meat-chicken hatchings fell back slightly to 35,572,000, though still second from highest ever. The record for hatchings was 37,629,000 in 1967–68.

Turkey poults hatched increased to 929,000, as against 628,000 in 1967–68.

DAIRY PRODUCTION DECLINING

Dairy products output again declined. Factory butter production was 23,290 tons in 1968–69; a sharp fall from the 31,820 tons in 1967–68 and 38,570 tons in 1966–67. Factory cheese output was 4,160 tons, compared with 4,840 tons the season before and 5,000 tons in 1966–67. Production of milk in the Milk Zone totalled 149,300,000 gallons, compared with 158,900,000 gallons in 1967–68 and 159,300,000 gallons in 1966–67.

EGGS—RECORD PRODUCTION

Commercial egg production reached a new record of 76,062,000 dozen. The previous record was 74,705,000 dozen, in 1967–68. This was the sixth successive year of increased production.

WOOL

First-hand deliveries of wool from the 1968–69 wool clip into the three main broker stores, Sydney, Newcastle, and Goulburn, totalled 1,428,157 bales during 1968–69. Deliveries in the previous 12 months (to June, 1968) totalled 1,423,345 bales.

Total receivals during the season, including carryovers from the previous period and wool received for re-sale, were 1,514,438 bales. Of these, 1,442,594 bales were sold. Total receivals the year before were 1,521,959 bales. Of these, 1,455,380 bales were sold.

After excluding 323 bales shipped abroad for sale, 71,521 unsold bales were held in store at the end of June, 1969.

STOCK NUMBERS

Sheep

At the end of March, 1969, the total of sheep and lambs in New South Wales was 68,200,000; higher than the 67,800,000 in March, 1968, but still well below the record 72,400,000 in March, 1965.

Cattle—Record Total

Cattle in New South Wales at the end of March, 1969, were estimated at a record 4,865,000, compared with 4,554,000 in March, 1968. The cattle population has finally exceeded the pre-drought, March, 1964, total of 4,789,000.

Pigs

The estimated total of pigs in New South Wales as at March, 1969, reached a new record of 688,000. The March, 1968, total of 645,200 was the previous record.

Notes on Some Committees, Councils, Trusts

AUSTRALIAN AGRICULTURAL COUNCIL AND STANDING COMMITTEE ON AGRICULTURE

Four meetings of Australian Agricultural Council were held; the first in Brisbane (July, 1968), the second in Canberra (August, 1968), the third in Hobart (March, 1969), and the fourth in Sydney (April, 1969). The August, 1968, and April, 1969, meetings dealt specifically with wheat stabilization.

FARRER MEMORIAL TRUST

Two ordinary meetings and the Annual Meeting of the Farrer Memorial Trust were held.

Mr C. S. Christian, a Member of the CSIRO Executive, was chosen as the Farrer Memorial Medallist for 1969. Arrangements were made for the Medal to be presented and the Memorial Oration to be delivered in conjunction with a gathering of the Australian Institute of Agricultural Science, at the University of Sydney.

Trust funds, in the form of maturing securities and funds not immediately needed for Scholarship purposes, were re-invested as follows: Rural Bank Inscribed Stock reinvested in Rural Bank Conversion Loan—\$2,000; Commonwealth Bank Inscribed Stock converted to Special Bond Series—\$3,980; Water Board securities reinvested in further Water Board Loan—\$400; Cash-in-hand not immediately required for Scholarship purposes, invested in Water Board Loan—\$1,200.

ROYAL BOTANIC GARDENS AND GOVERNMENT DOMAIN TRUST

Meetings of the Royal Botanic Gardens and Government Domain Trust were held on three occasions during the year, when the following matters were dealt with: Re-modelling of the Domain Baths; Leasing of the kiosk in the Royal Botanic Gardens; Proposed re-siting of glasshouses in the Royal Botanic Gardens; Erection of an electricity sub-station on a site adjoining the Naval Fuel Oil Tank Installation; Use of selected areas of the Royal Botanic Gardens for spectator vantage points during the Captain Cook Bi-Centenary Celebrations; and Extensions to the Art Gallery of New South Wales.

The Trustees have given permission for alienation of an area to the north of the present National Art Gallery building, for a Sculpture Court, to be opened in connection with construction of the new Captain Cook Wing.

Botanic Gardens Successes at Royal Show

The Royal Botanic Gardens exhibits were again distinguished entries at the N.S.W. Royal Agricultural Society's Easter Show. They gained 27 Championships, 56 First and 65 Second Prizes in the Foliage, Flowering and/or Berry Plants exhibits in the Horticultural Section. Several special trophy awards were gained, and also the runner-up award for the Banksia Medal—the highest award of the Royal Horticultural Society of England.

A Cold-climate Annex to the Royal Botanic Gardens

A property at Mount Tomah on the Bell's Line of Road, comprising 78 acres of natural bushland and cultivated areas on basalt and sandstone soils, has been donated. Action is being taken to complete the acquisition and develop the area as a cold-climate annex to the Royal Botanic Gardens.

STANDING COMMITTEE ON DROUGHT RELIEF

The position at 30th June, 1969, in respect of administration of Drought Relief Schemes is reported under "RESEARCH STATIONS BRANCH" (Page 18) by the Chief of that Branch—Chairman of the Committee.

Government emergency measures were maintained until conditions in the affected areas improved sufficiently during the 1969 autumn. The entire operation is now being reviewed to formulate a programme wherewith to deal expeditiously with any similar future situation.

DAIRY INDUSTRY ADVISORY COUNCIL

The Council (for terms of reference see the 1967–68 Report of the Department) submitted its report to the Minister for Agriculture in February, 1969. The report aims at unification and strengthening of the dairy industry and is now being considered by State Cabinet.

COMMITTEE OF ADVICE ON "THE INSTITUTE OF RURAL STUDIES"

For the Committee's terms of reference see the 1967–68 Report of the Department.

Pursuant to the intention to match higher entry standards with tertiary level training at the Hawkesbury and Wagga Agricultural Colleges, the Committee of Advice this year secured appointment of members to two Boards of Studies—a Board for the Diploma of Agriculture course and a combined (Food Science) Board for the Food Technology and Dairy Technology Diploma courses.

The Boards of Studies have in turn appointed subject Advisory Committees—each comprising representatives from Government Departments, Universities, industries and the Colleges. These Committees are to review curricula. Some account of their progress is included in the "HAWKESBURY AGRICULTURAL COLLEGE" section of this Report of the Department.

COMMONWEALTH AND STATES HORTICULTURAL COMMITTEE

By decision of Standing Committee on Agriculture there is now a Commonwealth and States Horticultural Committee—comprising Chief Horticulturists of the State Departments and a representative respectively from the Commonwealth Department of Health and Department of Primary Industry and the CSIRO. The Committee will advise the Standing Committee on Agriculture on horticultural matters such as: fruit and vegetable production and research; post-harvest, storage, packaging and transport research; horticultural research conferences; fruit and vegetable disinfection treatment; fruit and vegetable variety introductions, and interstate plant quarantine.

INTER-DEPARTMENTAL COMMITTEE ON HOME MAINTENANCE AREAS FOR HORTICULTURAL HOLDINGS

With three officers of the Water Conservation and Irrigation Commission, two officers of the Division of Horticulture comprise now an Inter-Departmental Committee for a detailed investigation of home maintenance areas for horticultural holdings throughout New South Wales. The Committee, set up by the Minister for Conservation with concurrence of the Minister for Agriculture, is a response to representations made by fruit growing organizations. These asked for an increase in maximum area of fruit crops landholders may irrigate in Irrigation Areas or by private diversions under license or authority of the Water Act.

COMMITTEE FOR SAFETY WITHIN THE DEPARTMENT

An intra-Departmental Committee concerned with safety has been established. Seven senior officers from Divisions, with the Assistant Secretary as Chairman and the Personnel Officer as Executive Officer, comprise the Committee.

Three meetings have been held and a safety programme has been put into effect. Safety officers have been designated, in all work-situations. They investigate accidents with a view to preventing recurrence, and pursue hazard-elimination before accidents occur. Safety publicity has been promoted through posters and booklets. Safety-courses have been arranged for supervisors and others. Accident report forms as advocated by the Standards Association are applied to any accident within the Department.

TECHNICAL ADVISORY COMMITTEES RE A SHEEP BREEDING CENTRE IN INDIA (COLOMBO PLAN AID)

In 1967 this Department agreed to a Department of External Affairs request to conduct a feasibility study of proposals for a Sheep Breeding Centre at Hissar, Haryana State, India. The Centre's principal objective would be to provide a significant number of pure-bred rams—raised as in Australia. These would be allocated to ram breeding centres in the main sheep breeding States of India for cross-breeding to improve the quality of the indigenous sheep. Subsequently three officers of this Department (Messrs C. J. Hawkins, Division of Animal Industry, and G. A. Crawford and J. H. Ballard, Division of Plant Industry) visited India (November, December, 1967) for 5 weeks to investigate the sheep and wool industry and in particular the proposed Sheep Breeding Centre site.

On their report the Department of External Affairs decided to negotiate with the Indian Government the establishment of the Sheep Breeding Centre. Development of the 7,000 acre site would require a \$960,000 contribution from Australia and \$1,222,000 from India.

The Department of Agriculture has agreed on establishment of a Technical Advisory Committee comprising three Departmental officers, to advise the Department of External Affairs on all matters relating to provision of staff, equipment and livestock for the project and the development of the site at Hissar.

Messrs R. D. Eastcoe, Division of Animal Industry, and G. A. Crawford and J. H. Ballard, Division of Plant Industry, comprise the Committee and have had a major role in staff and equipment acquisitions during the past year. A landholder in the Murrumbidgee Irrigation Area, and former Departmental officer, Mr H. Matthews, has been appointed as Project Manager—to take up duty on 1st July, 1969. Negotiations are in hand for \$70,000 worth of plant and equipment to develop irrigation and establish sheep handling facilities at the Hissar site.

The Technical Advisory Committee will continue to provide oversight and technical guidance over a 7 years development period. In this period 5,110 Corriedale ewes and rams will be transferred from Australia to India. Some 16,600 sheep will be carried at the site when development is complete.

Notes on Some Senior Officer Retirements

RETIREMENT OF THE CHIEF, DIVISION OF PLANT INDUSTRY—Mr W. H. POGGENDORFF

Mr W. H. Poggendorff, Chief of the Division of Plant Industry since 1947, retired on 16th August, 1968, after 44 years in the Department's services. He was succeeded as Chief by former Deputy Chief of the Division, Mr A. C. Orman.

As Chief, Mr Poggendorff directed the research, extension and allied activities of the Division of Plant Industry in the postwar years made difficult by equipment and staff shortages—to and through the rapid expansionary period of the '60s. The Division's soundness is a tribute to his leadership.

On graduating from the University of Sydney School of Agriculture his first appointment was as a plant breeder. His period in this vocation extended from 1928 to 1940—at the now Yanco Agricultural College and Research Station (then the Yanco Experiment Farm) and the now Leeton Agricultural Research Station (then the Leeton Rice Research Station). He ranks as one of Australia's outstanding plant breeders and was in fact the first Australian rice breeder. To him goes much of the credit for the varietal foundations whereon the N.S.W. rice industry—possibly the most efficient in the world—has been developed. Rice varieties he developed were Caloro, Caloro II (released in 1932; the variety the industry depended on until in 1966–67 Calrose replaced it as leader) and Colusa 180. His plant breeding and/or selection interests included also peaches ("Wight" and "Windra"), apricots ("Morocco"), table grapes ("Nyora") and rock melons ("King George"). There were many other crops.

In 1940 Mr Poggendorff accepted appointment to a new "Special Agronomist (Rice and Miscellaneous Crops)" position with headquarters in Sydney, to help meet a critical, wartime supply position in respect of various crops. His successes in these areas of endeavour were followed by appointment in 1947 to the position of Chief, Division of Plant Industry.

RETIREMENT OF THE ASSISTANT SECRETARY Mr S. W. WISE

Assistant Secretary Mr S. W. Wise retired on 13th September, 1968—after 47 years of service in the Department. He began his career as a Clerk in the Field Branch. In 1937 he became Private Secretary to the Minister and very capably served various Ministers and the Department in that capacity until 1951. During that period he served for 4 years in the AIF. He assumed special duties as Abattoirs Officer in 1951 and continued in that capacity until appointed Pastures Protection Officer in 1954. After his appointment as Chief Clerk in 1961 and subsequently as Assistant Secretary, Mr Wise was concerned largely with staff and personnel administration. He was noted always as a positive supervisor and administrator; closely concerned in adoption and development of many administrative improvements within the Department.

Mr J. J. McCormick, former Senior Clerk (Administration), has succeeded Mr Wise as Assistant Secretary.

RETIREMENT OF PRINCIPAL LIVESTOCK OFFICER (SHEEP AND WOOL)—Mr C. J. T. HAWKINS

Mr C. J. T. Hawkins, Principal Livestock Officer (Sheep and Wool), since 1960 retired in July, 1968. He was succeeded as Principal by Mr R. D. Eastoe.

Mr Hawkins' career with the Department of Agriculture extended over 39 years. He joined the Department in 1929 as an Assistant Sheep and Wool Instructor, served on various Research Stations and as a District Officer until 1954 and in that year was appointed as Special Livestock Officer (Sheep and Wool). In 1960 he was appointed to the top position in the sheep and wool industry extension services of the Division of Animal Industry, the position he occupied on retirement.

In the later stages of his career Mr Hawkins accepted secondment for a period as a Colombo Plan Adviser for an Indo-Australian Sheep Stud project in India.

Some Notable Developments CONCERNING LIVESTOCK INDUSTRIES

New Veterinary Research Buildings

The new wing at the Veterinary Research Station, Glenfield, to provide facilities for virology research, serological testing and staff amenities was completed and is now occupied. Additions to the parasitology section at Glenfield have been started.

The Tuberculosis Programme

The total of cattle tested under the Quarantine Areas compulsory testing scheme declined by comparison with the previous year; to 684,969, as against 845,516. This was because the lower level of infection allowed longer intervals between tests. Overall incidence of reactors was 0.08 per cent; the lowest since the testing programme started. Two more areas were added this year, bringing to eighty-two the total of Quarantine Areas for this programme.

Identification System for Sale Cattle

Plans have been finalised and regulations gazetted under the Stock Diseases Act, to introduce in the following year a system for compulsory identification of cattle offered for sale. Mainly it is to enable the source to be ascertained, when cattle carcasses at abattoirs are found infected with disease. A plastic tail tag carrying an identification number indicating the owner is the key.

Milk Production not Reduced by Cattle Dipping

A widespread belief among north coast farmers has been that acaricidal dipping of cattle reduces milk production. At the Cattle Tick Research Station, Wollongbar, the milk produced has been weighed for two to three days before and after eight dippings of one Government and seven private herds. In this study, no reduction in yield followed the dippings.

Mastitis Control Programme Launched

The first stage of a Mastitis Control Programme has been launched. The Programme was organized by a committee comprising representatives of this Department's Divisions of Animal Industry, Dairying, Science Services, Marketing and Agricultural Economics, and the Biometrical Branch, and of the University of Sydney and the N.S.W. Milk Board. The first stage involved setting up forty demonstration farms, the informing of owners in regard to the processes involved, and the provision of data for dissemination. Progress was made on near to 75 per cent of the intended forty farms. There is more detail in the Division of Animal Industry and Division of Dairying sections of this Report of the Department.

Measures Against Exotic Disease

The comprehensive plan against possible outbreak of foot and mouth disease has been finalized. Veterinary authorities in the States and in the Commonwealth Department of Health have agreed to it. Steps have been taken to familiarize all staff, and those who would be involved, with their functions if there were an outbreak. A senior Veterinary Officer attended the training course in exotic diseases conducted by the New Zealand Department of Agriculture.

A plan for safe disposal of milk during an outbreak is in formulation.

Trend to Merino, from Fat Lamb Production

The trend towards the Merino continued, accentuated by depressed prices for prime lambs. Within Merino production the distinct movement is towards finer wools, with owners of stronger woolled flocks using medium woolled rams and those with medium wool flocks using fine woolled rams.

A computerized weaning weight service has been introduced by the Department, but with only limited chance to implement it before the twelve months under report ended.

Sheep Blowflies and Organophosphorus Resistance

Further research has indicated that primary sheep blowfly (wherein resistance to organophosphorus chemicals was first diagnosed in late 1965) is unable to develop high-order resistance to this group of insecticides. Thus, the continued field use of these materials for flystrike prevention is unlikely to increase the order of resistance. Laboratory selection programmes have failed to increase above 10 to 15 times normal the order of resistance of the blowfly to organophosphorus chemicals.

American Interest in Beef Cattle Production

Americans' interest in beef cattle production in New South Wales has increased. There has been a large inflow of their capital, particularly in coastal areas. Much of the capital went into purchase of second class country, for development for beef production.

Poultry Genetics and Higher Egg Production

Genetic selection of poultry for egg production at the Poultry Research Station, Seven Hills, has in the past three years increased egg production by 3.82 eggs per bird per generation. In the same period, egg weight gained 0.52 grammes per generation.

Pig Nutrition Research

Studies of the poor performance of pigs fed a corn-meat meal diet, as compared with those fed a wheat-meat meal diet, showed it to be caused by severe deficiency of the essential amino acids—tryptophan and lysine. The work indicated meat meal to be a suitable source of supplementary protein for barley, oats, and wheat, but not for corn or sorghum.

Noxious Animals Research Established

A Research Officer (Noxious Animals) has been appointed at the Veterinary Research Station, Glenfield, to start a research programme into various aspects of noxious animals. Studies this year included rabbit control methods, the role of foxes in the spread of *Cysticercus ovis*, the biology of feral goats, and dingo physiology.

CONCERNING FIELD CROPS AND PASTURES

The Pilot Soil Testing Service for Phosphorus

A Pilot Regional Soil Testing Service for phosphorus on wheat was inaugurated at Wagga this year. It is based on research done at the Agricultural Institute, Wagga. In operation, the paddocks are sampled by field assistants, the soils are analysed at the Institute, and the results and recommendations are passed to the District Agronomist for interpretive advice to the farmer.

Near to 200 farmers in thirteen shires have applied to join the Service in this its initial year.

Wheat Nutrition Research re Sulphur

Further experiments in the north west by the Tamworth Research Directorate have shown clearly that wheat, even on very deficient soils, does not respond to sulphur fertilizer if normal cultural methods are used. Thus, there would be no objection on this score to the use of high analyses phosphatic fertilizer in lieu of superphosphate.

Hard Wheats for Southern New South Wales

Attitudes concerning southern N.S.W. wheat production quality standards have changed. The central and southern dryland zones have previously been regarded as soft wheat areas but the Department's hard wheat Falcon, and the rising grain protein levels, suggest that wheat industry interests might now be better served by basing the production on improved "hard" rather than "soft" varieties. There are far reaching implications for wheat growers, and for wheat breeders.

Fortunately, the past fifteen years of research at the Agricultural Research Institute, Wagga, has provided the essential technical knowledge for re-orientation of the breeding programmes: methods for classification of grain hardness, elucidation of the inheritance of such qualities, and an understanding of the impact of varying degrees of hardness on milling and baking behaviour. Thus the Department is ready to meet the needs and assist growers' efforts to satisfy the modern market.

An Excellent New Durum Wheat

A commercial milling test of the new Durum wheat (No 2030)—selected by the Agricultural Research Directorate at Tamworth—has shown it to be excellent for semolina yield and quality. Moreover, the wheat also resists lodging, being of semi-dwarf habit. It should find ready acceptance by farmers.

The "Australian Wheat Collection" at Tamworth

The "Australian Wheat Collection", established at Tamworth Agricultural Research Station, is now fully operative. The Curator has taken up duties. Storage facilities have been completed. All wheat varieties available in Australia are now housed there and most have been planted for seed renewal.

First Australian Semi-Dwarf Wheat (Wren): Not Recommended

The 1967-68 Annual Report mentioned that the first Australian-bred semi-dwarf variety (N. B. Javelin 115), bred at the Wagga Agricultural Research Institute, had performed exceptionally well and that application was being made for naming and registration with a view to this wheat being grown in higher rainfall regions and the irrigated areas of the southern wheat belt.

The crossbred has been registered as "Wren" but has not been accepted by the Standing Advisory Committee on Wheat for recommendation for commercial sowings. The Committee, mainly on the grounds of milling quality, felt that Wren would prejudice overseas marketing prospects.

Despite the Committee's non-recommendation of Wren, and the decision of the Australian Wheat Board not to issue permits for growers to dispose of seed, a significant acreage was sown to this variety in 1969—particularly in irrigation areas—because of outstanding yield performance under irrigation.

Rust Red Flour Beetle Resistance to Maldison

The occurrence, in Queensland, of strains of Rust Red Flour Beetle resistant to maldison posed serious problems. Maldison is a routine treatment to prevent insect infestation of wheat and other grain exports. A Statewide survey of silos, produce merchants and stock food manufacturers was done to ascertain whether New South Wales had acquired resistant strains of the pest. Six instances of maldison resistant beetles were recorded. Special regulatory action was taken to kill the resistant strains where they were located. This work is continuing.

Australian Plague Locust Threat

Development of three in lieu of the more usual two generations of plague locusts between October, 1968 and April, 1969, has yielded unusually high-density populations. Thus the threat of a major outbreak in the spring of 1969 is posed, through widespread and extensive egg-laying—if conditions favour survival of the young hoppers that would begin to hatch in late September.

Wingless Grasshopper Threat

The increasing pest-status of wingless grasshopper was further underlined this season. There were extensive, dense populations in tableland and sub-coastal areas, from the Victorian border to the northern tablelands. Particularly dense infestations and widespread damage occurred in the Marulan-Berrima district during the summer.

More Rice Records

The long succession of yield and production records set by the rice industry are due in no small way to the close co-operation between the Department and the various components of the industry; the Rice Growers' Association of Australia, the Rice Marketing Board of New South Wales, the Rice Growers' Co-operative Mills Ltd, the Irrigation Research and Extension Committee, and the growers and individuals.

New South Wales rice growers achieved in 1969 for the eighth successive year a record total yield from a record sown acreage, and also their highest yield average. The average was a little over three tons per acre, as against 2.79 tons in 1966, 2.86 tons in 1967, and 2.87 tons in 1968.

Approximately 250,500 tons of rice was harvested in 1969, from some 82,690 acres; about 33,000 tons more than the 1968 harvest.

Cotton Production Records Again

It has been estimated that despite adverse harvesting conditions a record 130,000 bales (480 lb) of raw cotton was produced in the 1968-69 season, as against 115,800 bales in 1967-68. Yield average was estimated at 2.14 bales per sown acre. The sown 60,787 acres was also a record area; about 7,300 acres more than in the 1967-68 season. Greatest expansion was in the Namoi Valley (52,000 acres sown). The Macquarie Valley and Bourke area sowed about 8,000 and South Western Irrigation Districts about 700 acres.

Australian Spinners' demands are in the vicinity of 130,000 bales. Of this total, some 15,000 bales are long stapled combing cotton not produced in Australia and have to be imported. With Australian production about 161,000 bales from the 1969 harvest there will be a surplus of say 46,000 bales. Some of this would be retained as "insurance" against harvest failure in 1970, but the rest has to be disposed of to best advantage by export.

First Australian Cotton Research Conference

The first Australian Cotton Research Conference has been held. This was in Narrabri from 3rd to 7th March, 1969. The Department was host but the Organizing Committee was representative of the CSIRO and the State Departments of Agriculture of Western Australia, Queensland and New South Wales. Sixty-seven delegates attended—from Commonwealth, State and university bodies and the cotton processing and spinning industries.

The major objective was achieved by bringing together cotton research and other workers from widely different environments for interchange of experience and data. Papers presented ranged from plant breeding through to marketing and fibre requirements.

CONCERNING FRUIT AND VEGETABLE CROPS

Orchard Pest Management Studies

The first stage of the Co-operative Pest Management Programme in Pome Fruit Orchards has been completed. Four Australian States and the CSIRO have collaborated in this for the last 3 years; studying pests and beneficial insects, and

mites, in apple orchards. Better understanding of the important apple pests and inter-relationships has been achieved. The Standing Committee on Agriculture has approved of an extension of the Programme for another 3 years.

Peach Rosette: Virus Disease in the M.I.A.

In the 1968 spring, all canning peach trees in the M.I.A. were surveyed, to assess the extent of infection by the virus complex Peach Rosette. Presence of this disease had been established in the previous season. The survey results will assist the research on this disease syndrome.

A New Systemic Fungicide

A new systemic fungicide on trial against a number of diseases could be the most important advance in fungicides for many years. It shows promise of solving the problem of stone fruit brown rot control, and against other major fruit diseases. Its registration for use on food crops awaits approval in terms of residue.

Assistance to Wine Industry Expansion

The continually increasing consumption of wines in Australia, and resultant shortage of wine and wine grapes, has further stimulated interest in growing wine grapes. Advice on the suitability of various regions and soils in New South Wales for wine grape growing, and on feasibility of establishing wine industry in these areas, is in heavy demand. Cowra, Coonabarabran, Narromine, Mulgoa and Cummoock districts have been surveyed for this purpose.

Also, new growers in established winegrape districts have been helped to choose suitable sites and establish a vineyard.

Clonal Selection and Introduction of Wine Grapes

A clonal selection programme for wine grapes has been launched. Its potential value was pointed to by a planting of Black Shiraz vines at Griffith Station. In this there were consistent, significant yield differences of up to 50 per cent between sets of vines propagated from different mother vines.

Now, 120 candidate clones of Black Shiraz and Semillon have been selected from Hunter Valley and MIA vineyards for planting at the Viticultural Research Station, Griffith. Amongst these are some that yielded at 8 tons per acre (Semillon) and 6 tons per acre (Black Shiraz) in non-irrigated Hunter Valley vineyards.

Also, forty-one selected high-performance clones have been imported from France, Germany and Switzerland.

Computer Studies of the Radiation Environment of Grapes

Rectangular and truncated triangle models to examine radiation interception by vines have been developed by computer. The photosynthetic capacities of Black Shiraz canopies have been estimated, using a descriptive model.

The results, and others, indicate that present trellising systems—at least in the case of vigorous varieties—provide inefficient utilisation of light. The Department's Griffith Viticultural Research Station and CSIRO officers at Griffith have co-operated in the work and have prepared a joint publication on parameters affecting photosynthesis in vines.

Rack Spraying of Drying Grapes

Rack spraying to hasten drying has been compared with the conventional bulk-dip method at Dareton. The new method dried the fruit more rapidly under the adverse conditions of this harvest. It substantially reduces labour and costs, and gives cleaner fruit—by avoiding the pick-up of grit by dip tins and the grit contamination likely in the bulk-dip tank.

Selected Sultana Clones for Distribution

District officers have supervised the planting of 95 acres of selected, high-performance sultana clones in the Lower Murray district—as a source of cuttings for future plantings. There should be by 1970 enough selected clones planting material for all new plantings.

Banana Transport in Polyethylene Bags

Successful long distance transport of bananas in polyethylene bags to Adelaide, from North Queensland and Coffs Harbour, has been achieved. The South Australian and Queensland Departments co-operated in the experiment. The previously developed method, using an ethylene absorbent (potassium permanganate), was highly satisfactory. An important effect in the polyethylene bags was prevention of mechanical injury of the fruit in contrast with injury in the commercial hand pack—apparently due to wilting and subsequent greater movement of the fruit sent in this way.

Control of Post-Harvest Diseases of Bananas

Banana growers are being advised on the use of thiabendazole (TBZ) as an alternative post-harvest fungicide to salicylanilide for bananas. Departmental research has shown that TBZ is superior. It controls both squitter and black-end whereas salicylanilide is ineffective against black-end.

Improvement of Canning Peach Varieties

A recent introduction ("Jan Neethling"), three locally bred selections and three late varieties have been added to the canning peach varieties under trial at Yanco Agricultural College and Research Station. There are now forty-one under trial. Canned samples of thirty-six varieties were evaluated at a Canning Peach Conference held in August, and two mutant Golden Queen selections—"Yanco Queen" (early) and "Taylor Queen" (late)—were recommended for district plantings. Budwood of these has now been released to nurserymen.

New Dessert Peach and Nectarine Varieties Tested

Dessert peach and nectarine varieties imported from U.S.A. are on trial at the Bathurst and Narara Stations, Hawkesbury Agricultural College, and at Arcadia, Glenorie, Menangle and Bilpin. Growers are keenly interested. Starking Delicious and Fragar have been accepted in commercial, coastal production and Redhaven extensively in tableland areas.

Nectared yellow fleshed nectarine varieties from America have been established in a Bathurst trial and further trees have been propagated for commercial district trials in a range of environments.

New Post-Harvest Fungicides for Apples and Pears

Chemicals of the benzimidazole group were screened for effect on post-harvest diseases of apples and pears. Post-harvest dips in thiabendazole, benomyl and parabendazole significantly reduced wastage caused by *Penicillium expansum* and *Botrytis cinerea*.

Controlled Atmosphere (CA) Storage of Apples and Pears

CA storage was subject of a highly successful extension school at Orange jointly organised with the CSIRO Division of Food Preservation. About 300 people attended. Every State was represented. Correctly managed CA storage ensures availability of high quality pome fruits for twelve months of the year.

Control of Post-Harvest Wastage of Citrus

An acceptable method of applying thiabendazole (TBZ) as an alternative fungicide to SOPP has been extended to the industry because of an impending world shortage of SOPP. In any case, TBZ is as effective in mould control and does not present rind injury problems.

Herbicide Management of Citrus

Herbicides have been shown to be an effective alternative to cultivation for weed control in citrus. It effects a big saving on the labour costs of conventional cultivation.

Citrus growers are being advised to develop their herbicide management system slowly, to adapt it to local situation, and use the best herbicide for the particular soil type and weed population. The herbicides programmes must vary from district to district.

Double Planting of Citrus

Double planting of Valencias, on sweet orange rootstock, at the Horticultural Research Station, Dareton, in 1960 has resulted in twice the yield of oranges per acre compared to normal-spaced trees—even though fertilizer and water were applied only on an acreage instead of a tree basis.

Competition for water has become apparent, but differential irrigation treatments will compensate for this. At the same time the double-planted trees show better utilization of the fertilizer applied.

Citrus Dwarf Trees; Close Planted

Close-planting of dwarf orange trees is being examined in several large trials at Yanco.

One trial involves Navels (a 1963 planting) and Valencias (1964) on trifoliata rootstock, where several dwarfing budlines are being compared in a 17' x 7' 4" close-planting (366 trees per acre). The Navels yielded over a bushel per tree in 1968 (their first crop year) and will exceed this in 1969; a very high return per acre for young trees. The Valencias, to be harvested in 1969 for the first time, are carrying well over a bushel per tree.

In another section, using several dwarfing budlines, rootstocks of Carrizo and Troyer citrange are being compared with trifoliata stocks. There are early indications that the dwarfing effects are less on the citranges than on trifoliata. Carrizo yielded 250 cases, Troyer 280 cases and trifoliata 140 cases per acre in their first crop year.



Dwarfed Orange Trees, Close-Planted

The dwarf orange trees, close-planted (366 trees per acre) in 1963 at Yanco Agricultural College and Research Station, yielded a bushel per acre in 1968 and 1½ bushels in 1969; a very high yield per acre for trees so young.

"Summer Death" Bean Disease Identified

This important disease of bean varieties of the processing type has now been shown to be caused by a virus or mycoplasma. It is transmitted by a cicadellid insect. Losses were particularly heavy this season. In fact the future of bean-processing industry in N.S.W. was in some doubt.

The research has revealed some bean varieties promising resistance to the disease. These will be basic in the immediate-future plantings in N.S.W.

Great interest aroused by the findings has led to visits to the U.S.A. by representatives of commercial firms, to arrange further introductions and seed supplies of suitable bean varieties for trials.

Mushroom Diseases Research Financed by Industry

The Mushroom Growers Association of Australia has contributed funds, supported by a matching amount from the Commonwealth Extension Services Grant, for appointment of a plant pathologist to study diseases of mushrooms, particularly virus diseases. The pathologist started on the work in February, 1969.

Electron Microscopy and Virus Diseases

A Phillips 300 electron microscope has been installed in a special building at Rydalmere and is now in service. Ancillary items including an ultra-microtome and shadow caster have been acquired. These facilities will greatly assist plant virus identification and research into virus diseases.

Microbiological Antagonists in the Soil

Dr K. F. Baker, Professor of Plant Pathology, Berkeley, California, spent four months of his sabbatical leave in the Division of Science Services. In collaboration with the Biology Branch he developed a method for study of soil micro-organisms that may be valuable antagonists to a range of soil inhabiting pathogens.

CONCERNING AGRICULTURAL COLLEGES

Acquisition of Tocal Agricultural College, Hunter Valley

By Ministerial statement in April, 1969, the Government announced acceptance of the offer from the Presbyterian Church and Alexander Bequest Trustees of Tocal Agricultural College in the Hunter Valley. The year 1970 will be the first year of academic responsibility of the Department of Agriculture for Tocal.

This acquisition and the in-hand establishment of Orange Agricultural College will increase from three to five the Department's Agricultural Colleges. It is of interest that Hawkesbury Agricultural College was established in 1891; that 58 years passed before the second was established—Wagga Agricultural College in 1949; and 14 more years before the third—Yanco Agricultural College—was established in 1963.

Increased Accommodation and Diversity of Training

Hawkesbury, Wagga and Yanco between them provide for 469 students in residence. Acquisition of Tocal, establishment of Orange Agricultural College and the in-hand construction of extra accommodation at Hawkesbury, Wagga and Yanco will provide for at least 400 more.

Tocal will offer a 12 months' Farm Certificate Course, similar to the Yanco Certificate. The Department receives twice as many applications for the Farm Certificate Course at Yanco as may be accommodated there.

A specialized Irrigation Certificate Course has been approved for Yanco, additional to the Farm Certificate Course. Intentions are that Tocal will also provide specialist courses, in dairy and beef cattle husbandry.

The Orange College will house 120 students and be co-educational. It will present a basic two-year course in management.

For Wagga Agricultural College a contract has been let for provision of two more dormitory blocks; seventy-two bedrooms. For Hawkesbury Agricultural College a contract has been let for another accommodation block; twenty-two bedrooms. And added accommodation at Yanco will accommodate twenty-five more students there.

Tertiary Level Training at Appropriate Colleges

Earlier mention (page 11) has been made of the Committee of Advice on Rural Studies—functioning as a co-ordinating, planning and advisory authority to the Government in the field of post-secondary agricultural education other than at universities.

An Advanced Dairy Technology Course, involving a third year, is part of the current up-grading at Hawkesbury Agricultural College. Other courses to commence at Hawkesbury, in 1970, are a 1-year Post Diploma Course in Rural Extension and a 2-year Poultry Technology Diploma Course.

Various Chief Lecturer positions have been established affecting both Hawkesbury and Wagga, to help effect the rise in standards of the various Diploma courses.

Within the Hawkesbury and Wagga Agricultural College sections of this Report of the Department there is more detail of actions in hand affecting the educational levels.

Finance—Summary

Consolidated Revenue Fund Expenditure and Receipts.—Expenditure from Consolidated Revenue Fund was \$16,377,276, which included \$2,466,735 for Cattle Tick Control and \$577,258 for upkeep of the Royal Botanic Gardens, Centennial Park and Admiralty House, part cost of which is recouped from the Commonwealth Government.

Expenditure by other Government Departments on behalf of the Department of Agriculture are shown in the Public Accounts, tabled in Parliament as an accompaniment to the Report of the Auditor General.

Receipts on Consolidated Revenue Fund were \$3,053,182 and these are shown in detail later in this report (*Appendix 1*—"The Accounts of the Department of Agriculture").

Capital Works.—Capital works were constructed and certain property acquired from General Loan Funds to the value of \$756,148—details are contained in *Appendix 1* to this report—"The Accounts of the Department of Agriculture".

Trust Funds.—Funds provided by industries, semi-Governmental bodies, Commonwealth Government grants and specialized taxations continue to rise. Substantial sections of the Department of Agriculture's research programmes and projects have been financed by these funds (and by special grants—see later "Commonwealth Extension Services Grant")—and the findings made available to primary producers and others.

Receipts and expenditure from the foregoing trusts and grants are recorded through the "Special Deposits Accounts" at the Treasury. Expenditure from these is regulated either by Act of Parliament or by such directions as may be given by the donor body, to whom the Department of Agriculture must account at the close of the financial year.

Some of the more important aspects of the operations on the Special Deposits Accounts are given in *Appendix 1*—"The Accounts of the Department of Agriculture—1968-69").

Commonwealth Extension Services Grant (C.E.S.G.)

Throughout this Report there are mentions illustrative of ways whereby the C.E.S.G. is helping and enhancing the extension services and allied applied research services of the various Divisions/Branches of the Department.

The Chief of Division of Extension Services is overall responsible to the Director-General for administration of the C.E.S.G. funds. He has included (page 148) in the DIVISION OF EXTENSION SERVICES section of this Report a listing (per Project No.) of the 1968-69 allocations. In total, the Department was allocated \$918,046 from the C.E.S.G. for 1968-69, compared with \$757,100 in 1967-68.

Research Administration/Co-ordination Office

Research Co-ordinator Mr K. E. Hutton participated in the First International Congress of Plant Pathology in London in July, 1968. He presented a paper "Control of apple scab (*Venturia inaequalis* (Cooke) Wint.) by decreasing overwintering inoculum."

He also visited research establishments in Israel, United Kingdom, U.S.A., Canada, and New Zealand on a brief study tour financed from the Commonwealth Extension Services Grant. During Mr Hutton's nine weeks' absence Mr J. E. Jessup, Executive Assistant to the Deputy Director-General (Research and Education), acted as Research Co-ordinator.

OVERSEAS STUDY TOURS AND POST-GRADUATE STUDIES

The Department continued a vigorous study leave policy. Some 11 per cent of the 331 research workers were on post-graduate study leave, at Australian or overseas universities, and a further 3 per cent participated in official study tours overseas.

An additional 12 per cent of the research staff had registered portion of their Departmental research project or projects with Australian universities, as studies towards the award of a Masters Degree.

The Department also maintained its training programme with the CSIRO, Canberra, assisted by funds from the Australian Wool Board. Twelve officers worked with CSIRO research teams during the year. The period of post-graduate training is of two or three years' duration in most cases.

RESEARCH GRANTS FROM INDUSTRY AND COMMONWEALTH FUNDS

The main grants to the Department from various Industry and Commonwealth funds to support the Department's research programmes are summarized in the following tabulation, with figures for the past 3 years to provide comparisons. Additional minor grants came from various Industries for specific items.

Source	1966-67	1967-68	1968-69	Totals
	\$	\$	\$	\$
Commonwealth Extension Services Grant (Estimate of Research Component)	165,000	277,200	559,941	1,002,141
Wheat Industry Research Committee of New South Wales ..	47,130	85,980	105,588	238,698
Wheat Industry Research Council ..	47,302	97,696	51,106	196,104
Wheat Industry Stabilization Fund	11,667	85,493	8,350	105,510
Australian Meat Research Committee ..	80,910	152,705	158,598	392,213
Wool Research Trust Fund	107,288	110,699	159,611	377,598
Australian Wool Board Post-Graduate Scholarships	11,974	10,871	16,520	39,365
Australian Dairy Produce Board ..	67,158	65,998	65,944	199,100
Banana Research Advisory Committee ..	5,700	10,300	9,900	25,900
Honey Research Advisory Committee ..	4,800	2,800		7,600
Tobacco Industry Trust Account ..	67,630	36,410	77,760	181,800
Australian Apple and Pear Board ..	13,600	8,200	10,420	32,220
Spray Residues Research (Commonwealth Grant)	11,600	11,100		22,700
Totals	\$ 641,759	955,452	1,223,738	2,820,949

These grants effectively support the basic State contribution to the Department's research service and enhance the research return from the State's basic investment. The grants also are an indication of the rural industries' confidence in the Department's research.

PROJECTS INITIATED WITH INDUSTRY AND COMMONWEALTH FUNDS

The major part of the industry grants received during 1968-69 were for continuation of the existing research programme. However, some approved new projects were initiated with the funds this year.

Australian Wool Board

Division of Science Services, Rydalmere.—Towards purchase of X-ray spectrograph and diffractometer, \$26,000.

Veterinary Research Station, Glenfield.—Development and use of various biochemical parameters in diagnosis, \$5,177.

Division of Plant Industry (in conjunction with CSIRO, Canberra).—Developmental pasture research in the cool, wet areas of the N.S.W. southern tablelands, \$9,190; training of a research agronomist via a study of the interactions between pasture species, plant nutrients, and soils of the N.S.W. southern tablelands, \$5,420; training of a research agronomist via a study of the influence of seasonal growth rates and quality of pastures in determining animal production, \$5,420; training of research agronomist via a study of fodder conservation practices to fill the winter feed gap on the northern tablelands, \$5,740; training of research agronomist via a study of forage crops to fill the winter feed gap on the northern tablelands, \$5,740.

Australian Meat Research Committee

No new beef project was supported during 1968-69, but the following new mutton and lamb project was initiated:

Agricultural Research Station, Trangie.—Evaluation of selection and management practices in terms of carcase characteristics, \$2,520.

Wheat Industry Research Committee of N.S.W.

Agricultural Research Station, Tamworth.—Soil factors associated with nutrient deficiencies in wheat, \$4,050.

Agricultural Research Institute, Wagga Wagga.—Pilot regional soil testing service for phosphorus on wheat, \$5,400; critical levels of soil nitrogen in the southern wheatbelt—stage 2, \$6,800; a study of fertilizer nitrogen reactions in wheatbelt soils, \$5,500; grain counter, \$600.

Wheat Industry Research Council

Agricultural Research Station, Tamworth.—Equipping of substation for wheat research, \$4,401.

Wheat Industry Stabilization Fund

Agricultural Research Institute, Wagga Wagga.—Fencing and watering facilities for wheat research, \$3,150.

Agricultural Research Station, Tamworth.—Plot harvester and tandem bogey trailers, \$5,200.

Australian Dairy Produce Board

Agricultural Research Station, Wollongbar.—Farm management economics in North Coast dairying, \$9,350.

Division of Science Services, Rydalmere, and Veterinary Research Station, Glenfield.—Mastitis research and control, \$1,800.

Commonwealth Extension Services Grant

This fund was directed in part towards improvement of research facilities at various of the Department's central laboratories and regional research centres. The largest specific approval was \$570,000, to be phased over three financial years, to erect a laboratory block at the Agricultural Research Station, Wollongbar.

Major allocations for 1968-69 included:

Division of Science Services, Rydalmere.—X-ray spectrometer and ancillary equipment, \$50,000, glass house for agronomic research, \$15,000.

Veterinary Research Station, Glenfield.—Agricultural engineering centre, \$42,500, parasitology laboratory, \$32,836.

Agricultural Research Station, Leeton, and Agricultural College and Research Station, Yanco.—Equipment for irrigation research, \$24,815.

Agricultural Research Station, Wollongbar.—Laboratory construction (phase 1), \$50,000, pig farrowing facilities, \$20,020.

Agricultural Research Station, Narrabri.—Oil seed research equipment, \$15,000.

C.E.S.G.—Special Research and Other Services Grant

Division of Science Services, Rydalmere.—Mushroom research, \$7,000. The Commonwealth contribution to this project was \$3,500 as a grant to match a contribution of \$3,500 from the Australian Mushroom Growers' Association.

PROJECTS INITIATED WITH STATE FUNDS

Eight new projects were approved for 1968-69:

Division of Plant Industry

Feed-year systems stocking rate trial (a sheep-grazing project jointly with Division of Animal Industry), Agricultural Research Station, Temora. Properties of tropical pastures species affecting cattle production (Agricultural Research Station, Wollongbar).

Division of Horticulture

Citrus nutrition trial, Horticultural Research Station, Dareton; maturity studies with Granny Smith apples, CSIRO Division of Food Preservation, North Ryde; peach soil management trial, Agricultural Research Station, Bathurst; nectarine variety trial, Agricultural Research Station, Bathurst; vine clonal selection, Viticultural Research Station, Griffith.

Division of Dairying

The influence of biological operating parameters on the continuous fermentation of skim milk, Hawkesbury Agricultural College, Richmond.

Research Stations Branch

Investigation of grain aeration system in farm storages, Agricultural Research Station, Condobolin.

RESEARCH REVIEWS

Agricultural Research Institute, Wagga Wagga

Appropriate action has now been taken on all nineteen recommendations of the Research Review Committee of 1967. These actions have benefited the Institute and its research programmes.

Chemistry Branch, Division of Science Services, Rydalmere

Review of the functions and research programmes of the Chemistry Branch was undertaken by the Deputy Director-General (Research and Education) and the Research Coordinator. The Branch is pursuing a laqueate research pro-

grammes, and providing sound chemical backing for other Departmental research teams in co-operative research projects. The Branch is also providing valuable, highly skilled technical services to the rural industries and to the Department's extension services.

Effectiveness of the Branch in the Department's research services has been enhanced in recent years by the rapid advances in instrumentation. This is enabling a greatly increased output of analyses and providing a more reliable statistical backing for the Chemistry Branch's research programmes. Some work areas where additional research effort and financial support are needed were identified.

Research Scientist Classification

A Research Scientist classification was introduced within the Public Service Board's office this year and has application through the Public Service. It is designed to provide "a special and personal salary for a research worker of exceptional calibre, who may prefer to specialize in the research field". Scientists admitted to this classification will be transferred to "a special seniority department in the office of the Public Service Board and seconded back to the Department in which they are employed". At Senior Research Scientist level the salary parallels that provided for research administrators.

The Department initially submitted the qualifications of eleven research workers for consideration for admission to the classification. Subsequently, another five officers applied for admission to the classification. The number so far admitted is not yet known. Some applicants have yet to be interviewed by the Qualifications Committee.

Automatic Data Processing Section

Citrus Leaf Analysis System.—The A.D.P. system for Citrus Leaf Analysis was completed in November, 1968. This provides for the recording and analysis of data from field observations and from laboratory analyses of leaf samples to determine the nutritional status of trees under investigation. From the computer analysis the effects of recommended rates of fertilizer dressings and nutrient sprays are assessed and recommendations made for future fertilizer usage.

Beef Cattle Performance Recording.—The first stage of the A.D.P. system for Beef Cattle Performance Recording was completed in July, 1968. The remaining two stages will be in operation in August, 1969. This project enables analyses of growth rates from birth to weaning, and to yearling age, and assessments of performance of dams and sires. At present the records of nineteen herds are being processed in this way.

A committee representing all States and the Commonwealth is examining the possibility of adapting this programme for use by other States and the Northern Territory.

Other Projects.—Several other potential A.D.P. projects are under investigation. These include: the calculation of fruit planting statistics for the Division of Horticulture; recording and information retrieval systems for the Plant Pathology Herbarium Collection, Division of Science Services; and the Australian Wheat Collection, Agricultural Research Station, Tamworth.

Dairy Herd Recording System.—Some re-design and re-programming of the dairy herd recording system has been carried out in preparation for transfer of this work from the Treasury's H-400 computer to the new H-8200 to be installed later in 1969.

A.D.P. Training Courses.—This year thirty-five Departmental officers attended A.D.P. training courses conducted by the Treasury A.D.P. Service Bureau.

RESEARCH STATIONS BRANCH

Administration of Drought Relief Schemes

The critical drought conditions continued well into the 1968-69 financial year. Government emergency measures were maintained until conditions in the affected areas sufficiently improved during the 1969 autumn.

The full cost of State Government financing of the special drought relief measures was borne by the Commonwealth up to 30th September, 1968, and thereafter this assistance was progressively withdrawn. Between the end of September, 1968, and the date that a district declared drought stricken at that time was removed from the "drought declared" list, Commonwealth assistance was dollar for dollar (and was confined to seven Pastures Protection Board districts—Cobar, Moss Vale, Braidwood, Goulburn, Cooma, Bombala and Eden), except that for restocking purposes—including return of starving stock. For the latter circumstances it was limited to the seven districts after 31st December, 1968.

All Commonwealth assistance ended on 30th June, 1969, except that for restocking purposes in the seven districts.

Although the administrative machinery had been built up urgently, it had functioned very successfully. The early decision to delegate to local officers such matters as approval to move stock streamlined the procedures and, as well, ensured better supervision of the scheme's requirements. The entire operation is now being reviewed to formulate a programme wherewith to deal expeditiously with any similar future situation.

Apart from loans and other forms of general assistance, the direct help by way of subsidies (for transport of fodder, transport of stock to and from agistment, and restocking) involved expenditure of \$1,019,084. The cost of cloud seeding is not in that total.

Some 121,500 bales of donated hay assisted stockowners, on the far south coast especially. The Government arranged for the donated fodder to be paddock-inspected and transported, free of cost, to depots in the affected areas. Between 14th November and 25th December, 1968, some 93,000 bales of hay were distributed to the Bega area, 23,000 to the Moruya/Tilba area, and 5,500 to the Southern Tablelands and Monaro area. Motor trucks, elevators and farm hands from Leeton Agricultural Research Station, Yanco Agricultural College and Research Station, and Wagga Agricultural College, collected the fodder from paddocks and transported it to central pick-up centres.

The Unemployment Drought Relief Committee allocated \$10,000, further to the \$15,000 allocated in the previous fiscal year, to enable at research stations the employment of persons affected by the drought. Such labour (secured through the Commonwealth Employment Service) was used at several research stations for fencing, pruning, repairing roads, kerbing and guttering, and amenities constructional work at Yanco Agricultural College and Research Station. This scheme ended in September, 1968.

Property Improvement at the Institutions

ACQUISITION OF LAND

No new station was established but extra areas of land were acquired or leased for existing institutions.

Some 900 acres, previously the Grafton Common, was acquired as additional area for Grafton Agricultural Research Station. The added potential will have special value for beef cattle research work. Also, 224 acres of grazing land near the Station was leased (initially for ten years) for beef cattle research.

A sub-station at Breeza for Tamworth Agricultural Research Station was established by transfer of control of some 230 acres of Travelling Stock Reserve.

Orange Agricultural Research Station was enlarged to 420 acres by transfer of two Travelling Stock and Camping Reserves (22 acres in all) from Bathurst Pastures Protection Board.

For Narrabri Agricultural Research Station negotiations are in hand towards acquiring 430 additional acres for essential expansion of research—with particular regard for cotton, oil crops and pastures under irrigation.

CAPITAL WORKS

Overall

The expanding capital works programme comprised structures for research, education and housing aggregating (including land acquisition and irrigation development) in excess of \$1,386,000. Expenditure from the various sources of finance was as follows: General Loan Account, \$756,148; States Grants (Advanced Education) Act, 1967, \$186,500; States Grants (Technical Training) Act, 1965, \$72,903; States Grants (Technical Training) Act, 1968, \$79,310; Commonwealth Extension Services Grant, \$156,390; Industry Funds, \$134,893; total—\$1,386,044.

With General Loan Account Funds

Jobs undertaken or in progress with funds from this source included office extensions at Alstonville Agricultural Research Station; at Condobolin Agricultural Research Station a Machinery Shed and Foreman's Store; at Glenfield Veterinary Research Station a new Boiler and Autoclave, a Virology Laboratory and a Conference Room; at Hawkesbury Agricultural College a Research Laboratory for the School of Dairy Technology; at Narrabri a Cotton Plant Breeders Shed; at Orange, acquisition of land for the new Agricultural College; at Rydalmere a Plant Quarantine Station; at Seven Hills Poultry Research Station two Brooder Houses, and site-preparation for the Administration and Laboratory Blocks; at Tamworth Agricultural Research Station a cottage; at Wollongbar Agricultural Research Station a Feed Shed and a Growing Shed for pigs.

With State Grants (Advanced Education) Act Funds

The States Grants (Advanced Education) Act funds provided for a \$1,422,000 capital works programme at Hawkesbury and Wagga Agricultural Colleges during the 1967-69 calendar years, to enable each to qualify as a College of Advanced Education by 1st January, 1970. The programme has now advanced to the stage where contracts for the major works have been let by the Department of Public Works and nearly all jobs actually commenced; with most of the smaller works either complete or nearing completion.

Expenditure during 1968-69 was \$186,500 increasing gross expenditure on the programme from the first triennium, to date, to \$215,606, viz.:

	Estimated cost	Gross expenditure to 30-6-69
Hawkesbury Agricultural College—	\$	\$
School of Food Technology—Tutorial Block	239,000	1,908
Poultry Section	49,247	3,168
Residential accommodation	204,500	5,034
Laboratory—Lecture Room, Dairy Technology..	61,265	56,372
Equipment	36,000	..
Wagga Agricultural College—		
Dining Room and Kitchen	315,400	24,933
Residential accommodation	417,700	82,218
Animal and Plant Science Laboratory (total estimated cost \$330,000)	71,500	7,818
Equipment	36,000	9,351
Augmented Water Supply	9,351	8,730
Sports Facilities	13,000	5,400
Roads	5,400	1,720
Development Plan	3,000	..
New Boiler	57,400	8,554
Machinery Shed	8,554	..
	\$ 1,421,317	215,606

With State Grants (Technical Training) Act Funds

Expenditure of \$152,213 from the State Grants (Technical Training) Act funds comprised \$72,903, in respect of the triennium 1965-1968 programme and \$79,310 from the second triennium programme, 1968-1971.

The first triennium's programme is now virtually complete. The 1968-69 expenditure was mostly on the Animal Husbandry Unit (Stage I) at Hawkesbury Agricultural College. Overall expenditure on the first triennium programme has now aggregated \$810,530, from grants totalling \$863,240.

The second triennium programme embraces works to the extent of \$1,227,000. Actual expenditure for this first year of the three was only \$79,310, but contracts were either let or in preparation by the Department of Public Works for these major works:

	\$
Hawkesbury Agricultural College:	
Animal Husbandry Unit (Stage II)	177,000
Physics Laboratory and Lecture Room	156,000
Wagga Agricultural College:	
Animal and Plant Science Laboratory	258,000
Yanco Agricultural College:	
Accommodation Block	300,000
	<u>\$891,000</u>

With Commonwealth Extension Services Grant Funds

All capital works undertaken with C.E.S.G. Funds were designed and supervised by the Architects Branch. These included the Regional Laboratory, Wollongbar, estimated to cost \$525,000 (\$350,000 of this is expected to be disbursed during 1969-70). Plans are proceeding for erection in 1969-70 of a plant nutrition glasshouse at the Division of Science Services, Rydalmere, estimated to cost \$15,000, and an Agricultural Engineering Centre at the Veterinary Research Station, Glenfield, at an estimated cost of \$32,500.

Expenditure during 1968-69 aggregated \$156,389 and seven jobs were completed, viz.:

	Total Cost
	\$
Tropical Fruit Research Station, Alstonville:	
Controlled Plant Growth Chamber	11,878
Agricultural Research Station, Bathurst:	
Constant Temperature Room	610
Horticultural Research Station, Dareton:	
Glasshouse	11,649
Viticultural Research Station, Griffith:	
Glasshouse	11,295
Vine Root Observation Chamber	3,420

Division of Science Services, Rydalmere:	\$
Supply and installation of Electron Microscope ..	52,561
Building for Electron Microscope	31,340
Agricultural Research Station, Trangie:	
Animal Surgery Building	7,990

The following partly completed jobs are expected to be finished during 1969-70:

	Est. Cost
	\$
Veterinary Research Station, Glenfield:	
Parasitology Laboratory	26,500
Agricultural Research Station, Wollongbar:	
Pig Farrowing Building	16,000
Agricultural Research Station, Orange:	
Potato Evaluation Room	3,000

With Industry Grants Funds

Capital works financed from various Industry funds aggregated \$134,793 expenditure during 1968-69. These were wholly designed and supervised by the Architects Branch staff. The following were completed:

	Total Expenditure
	\$
Ashford Tobacco Research Station:	
Administration Building and two Barns	23,932
Tamworth Agricultural Research Station:	
Australian Wheat Collection Building	33,547
Insect Proof Glasshouse—Lucerne Breeding	10,613
Pathology Glasshouse	13,928
Controlled Environment Plant Growth Chamber ..	10,675
Trangie Agricultural Research Station:	
Sheep Fertility Laboratory	27,990
Wagga Agricultural Research Institute:	
Temperature Controlled Building (Stage I-II)* ..	6,595
Glasshouse for Wheat Cytogenetics	10,715

* Stage III of the Temperature Controlled Building—estimated to cost an additional \$19,500—is planned for completion in 1969-70.

Plans were completed for the Drought Feeding Laboratory, Glenfield Veterinary Research Station; estimated cost, \$92,000.

At Western Division Public Watering Places

Whilst maintenance continued at a rate of expenditure similar to that of the previous year, and aggregated \$89,746, new works undertaken included a stock-trucking yard at Mackinnon Tank (Cobar Pastures Protection District) for \$2,100, and the sinking of three bores on the Wilcannia-Menindee Travelling Stock Route for \$5,847.

The improvements and maintenance works have during the last four years aggregated \$480,000 from Consolidated Revenue Funds. Work to bring to a satisfactory standard the remainder of the 325 Public Watering Places in the Western Division is continuing.

RESEARCH STATIONS IMPROVEMENTS: OTHER THAN CAPITAL WORKS PROGRAMME

Fences, Roads, Aesthetics, Clearing

Apart from the capital works programme the following improvements were effected on the eighteen Research Stations under the control of this Branch:

Fencing.—Research programmes called for considerable sub-divisional fencing; particularly at Wollongbar, Condobolin and Grafton—a total of some 922 chains erected—but also at Orange, Tamworth, Leeton and Cowra. Boundary fencing was renewed at Narara, Yanco, and Orange, and 1,200 ft of security type fencing erected at Seven Hills. Electric fencing materials to the value of \$1,900 were provided for the Agricultural Engineering Section (see later).

Materials costing \$15,000 were used this year in erecting 5 miles of boundary and 18 miles of sub-division fencing.

Roadworks.—Some \$3,675 was expended on bitumen re-surfacing of roads and surrounds at Yanco, Dareton and Narabri. A lot more bitumen sealing and re-surfacing are needed, but funds were unable to cope.

Internal roads received necessary attention, particularly at Alstonville, Condobolin, Leeton, Yanco and Trangie. Trangie Station received a large self-propelled road-grader. This is proving invaluable for grading the miles of roadways on this 10,000 acre property and will also be very useful for the irrigation development work (500 acres) due to start soon.

Drought relief funds were used for labour during July to September to continue at Yanco and Dareton the road repairs and kerbing and guttering.

Aesthetics.—Entrances and approaches to the Stations, and the surrounds of the buildings, have been much improved—with accent on establishment of lawns and plantings of shrubs and trees.

At Bathurst more trees were planted and additional flowering trees were "worked" in the nursery, for plantings in 1970.

At Alstonville great improvement has been achieved in the main administrative area by expansion of the lawns, erection of a park rail-type fence—from the nursery to the packing shed—and a stone retaining wall for the plant nutrition section.

At Wollongbar (Agricultural Research Station), a new entrance ramp and matching brick pillars; at Trangie, over 100 Eucalypt and Kurrajong trees planted; at Condobolin, the existing four miles of double and triple row plantings of shade and shelter belts were extended by planting 42 chains more this year.

Flood Mitigation and Earthworks.—Soil Conservation Service plant was hired for construction, re-alignment and general maintenance of contour banks for soil erosion control at Tamworth.

At Duck Creek Sub-Station (of Grafton Agricultural Research Station) the Richmond River County Council is engaged in a comprehensive flood mitigation programme, additional to that done by the Department in 1967–68. The construction comprises large levee banks—planned to alleviate all flooding of Station property and to provide vehicular movement along each embankment.

Land Clearing.—Almost \$4,000 was expended in land clearing operations at Grafton, Condobolin, Trangie and Narara Stations, in preparation for future research work. At Trangie, 500 acres were cleared in preparation for irrigation due to start soon. At Narrabri the 48 acres recently transferred from Pastures Protection Board control were levelled ready for irrigation needed for research.

Machinery and Equipment

From Consolidated Revenue Funds a further \$75,000 was expended to purchase equipment, apparatus and machinery. Tractors, a forage harvester, a seed grader, combines, a dumpy level, mowers, slashers, rotary hoes, ploughs, pumps and spraying attachments, irrigation equipment, grain storage facilities and augers, fertilizer spreaders, ditch cleaner and precision seeder aggregated some \$40,000.

Specifically for research, the purchased plant included an infra-red gas analyser, balances, a refractometer, a spectrophotometer, a deionizer, incubators, an autoclave, a gas

chromatograph, a dehydrator, a bomb calorimeter, laboratory ovens, a Rockwell hardness tester and air speed measurement equipment, aggregating some \$35,000.

From Commonwealth Extension Services Grant funds plant to the value of \$80,000 was purchased for Research centres. Notable components were \$10,000 for equipment for the Engineering Centre at Glenfield, \$15,000 on equipment to assist plant physiology research at Narrabri, and \$24,815 for irrigation research equipment at Leeton.

Industry Funds also made substantial grants for material, plant and equipment for research projects at the Stations.

Stores, Minor Plant, etc.

For research stations and the Yanco Agricultural College and Research Station, stores, minor plant and equipment, repairs to plant and equipment and other essential services aggregated \$203,000; an increase of \$23,000 over the previous year's figure.

Water Supply and Irrigation

The Department joined the Trangie-Nevertire Irrigation Scheme and Trangie Station has been allocated an irrigation area of 500 acres. A soil survey of this area has been done by the Chemists Branch. The irrigation-supply channel works should be completed in time for irrigation to start in 1969–70.

To provide a more satisfactory irrigation water supply for Glenfield Veterinary Research Station, a large earthen-walled dam is to be built across a gully adjacent to the Bunburry Curran Creek. The site has been selected and samples of underground strata submitted to the Water Conservation and Irrigation Commission for testing. The wall would contain about 8,500 cubic yards of filling and enable storage of some 20.8 acre feet of irrigation water. Construction work must await the State Planning Authority's completion of plans for rationalising the Creek's course.

At Dareton, because of increase in acreage of fruit planted for research, a new agreement was arranged with the Water Conservation and Irrigation Commission—to supply irrigation water for a maximum of 100 acres—effective for 20 years in lieu of the previous agreement which ended in 1968.

At Condobolin, an automatic electric pump was installed to replace a diesel power unit for the domestic and stock water supply.

Effected improvements and extensions this year to domestic, stock and irrigation water supplies aggregated an expenditure of \$20,000.



Research Station Field Day at Leeton

This summer-crops field day, typical of the various Research Stations' contributions to extension service effectiveness, drew a big attendance. The visitors are inspecting hybrid grain sorghum trials wherein the yields were 3½–4 ton/acre.

Maintenance and Operational Activities at the Institutions

Maintenance

Major maintenance at Research Stations this year comprised: renovations to cottages at Narara, Trangie and Wollongbar; repair of a machinery/workshop and renewal of the administrative building roof at Dareton; painting three cottages at Bathurst, two at Grafton and one at Griffith; alterations to an agronomy building to provide laboratory space at Condobolin, and of one at Temora to provide more office space; a frost laboratory at Tamworth; a bulk storage shed at Wollongbar; a vehicle and machinery shed, and painting and repairs to buildings, at Trangie. In all, \$70,500 was expended on this work.

Also, a \$3,200 bulk storage shed was erected at Cobar to facilitate operations at the Public Watering Places Western Division Depot.

Operational

Seed Production.—Winter cereal seed harvested at research stations (1,660 bushels of oats, 200 of wheat, 170 of barley and 20 of cereal rye) was sufficient in quantity and range to meet Departmental needs for domestic crop production.

Fodder Production and Use.—Stocks of grain, hay and other fodder increased considerably after the drought broke. The total fodder held on research stations at 30th June, 1969, comprised: 67,900 bushels of grain (valued at \$28,345) and 1,772 tons of hay (valued at \$81,423). There is also 490 tons of silage, held for supplementary or drought feeding.

Some 1,400 acres of oats, 915 acres of wheat and 80 acres of barley had been sown by 30th June, 1969; slightly less than at that period of 1968.

Livestock.—The critical position reached at the close of the previous fiscal year continued for a few months in some areas. Stock at most research stations held condition well. 150 breeders located at Leeton and Orange Agricultural Research Stations during the drought were returned to Trangie Agricultural Research Station in October.

Excellent autumn conditions led to growth of feed far in excess of stock needs at several Stations. Trangie, which had experienced a dry spring, purchased some 200 head of store cattle from special funds to assist in consuming the excess pasture growth, and reduce the anticipated fire hazard. Pasture growth was excess also at Temora, Cowra and Condobolin, and all available surplus sheep were immediately transferred to assist in managing it. Grafton, Wollongbar and Glen Innes did not get an autumn break in the dry conditions but no major reduction of stock was needed—because stocks of fodder were adequate—and by the end of the fiscal year the conditions had improved at these Stations.

Stock numbers on the eighteen Research Stations (i.e. including Yanco Agricultural College and Research Station but excluding Hawkesbury and Wagga Agricultural Colleges) at 31st March, 1969, were: cattle (beef and dairy—all types), 1,877; sheep (all types including lambs), 21,567; pigs (all types), 287; poultry (pullets, hens and cockerels), 6,886; horses, 48.

Miscellaneous Matters

MOTOR VEHICLES FOR THE DEPARTMENT

This was the first year wherein all administrative matters in connection with supply of additional and replacement motor vehicles for the Department as a whole were dealt with by the Research Stations Branch. The Department's motor vehicle fleet total now stands at 254.

This year seventy-seven existing vehicles were replaced by new ones and thirty-three additional motor vehicles (ranging from very small sedans to trucks and buses) were delivered.

The light front-wheel drive run-about supplied in 1968 to various Stations and to Hawkesbury Agricultural College and the Royal Botanic Gardens, has been extremely practical and economical for short "on station" running. The supply of more is likely.

EXTENSION WORK BY RESEARCH STATIONS

Public interest in the Research Stations continued at a high level, and with good co-operation from the local press, television and radio stations. Twelve Field Days held at Research Stations this year aggregated an attendance of about 2,400 visitors.

Most Stations reported also an increased volume of visitors other than for Field Days. At Narrabri, for example, five bus loads (180 visitors) inspected the Station in June; near to 1,000 visitors inspected Alstonville Tropical Fruit Research Station in August, and 800 visited Wollongbar in that month.

Seven television appearances were made, by five of the Research Station Managers. Their topic in general was "Progress of Research Work".

LIAISON ACTIVITIES

Research Stations Branch officers were heavily engaged by a wide range of miscellaneous activities. These included membership of the Standing Committee on Drought Relief, the Agricultural Machinery Sub-Committee of Review—established by the Wheat Industry Research Council, a Sub-Committee attached to the Board of Secondary School Studies to prepare three new courses on "Agricultural Engineering" for Higher School Certificate pupils, the Board of Studies for curricula at Hawkesbury and Wagga Agricultural Colleges, the Executive Advisory Committee for Safety in Rural Industries, and the Bushfire Committee of N.S.W. Also, liaison was maintained with industry, external research establishments, the universities, and the Standards Association of Australia.

STAFF

Additional positions were established at several Stations: by increasing the Field Assistant establishment by fourteen positions, among eight Stations; by adding a Technical Officer (Scientific) to each of four Stations; by adding a Laboratory Attendant to each of two stations; and by one Leading Hand; a full-time office assistant was provided at Condobolin, a shorthandwriter typist at Tamworth, an additional office assistant at each of three stations and one at head office. New positions approved and awaiting the appointment of staff include an Architect Grade I, a Manager for Orange Agricultural Research Station, an assistant for the potato breeder at Orange and one for the plant pathologist at Wollongbar.

The Cowra Manager was transferred to Hawkesbury Agricultural College, as Farm Supervisor; the Temora Manager to Cowra; the Narrabri Manager to Temora; and former Gun-nedah District Agronomist Mr R. F. Komoll is now Manager at Narrabri Station.

The Plant Inspectors and their various duties are now under the administration of the Agricultural Engineer. The establishment provides three positions but two are vacant—one of these for almost 3 years. To overcome the recruitment problem, proposals for reclassification and reorganization of duties of the positions are in hand.

Agricultural Engineer Section

RESEARCH AND INVESTIGATIONS

Agricultural Engineering Centre to be Established

Purposes.—Establishment of an Agricultural Engineering Centre for research into agricultural engineering and farm mechanization problems, and of a workshop unit where specialized equipment can be made for Departmental research officers, has been approved.

Location.—The site is at the Veterinary Research Station, Glenfield, and was chosen because of the availability there of farming land, livestock, a dairy, farming equipment, and irrigation. Also, its proximity to industrial areas will assist procurement of suitable staff and be time-saving in getting materials from engineers' supply firms. Furthermore, it is not far from N.S.W. head office of most of the major farm machinery companies.

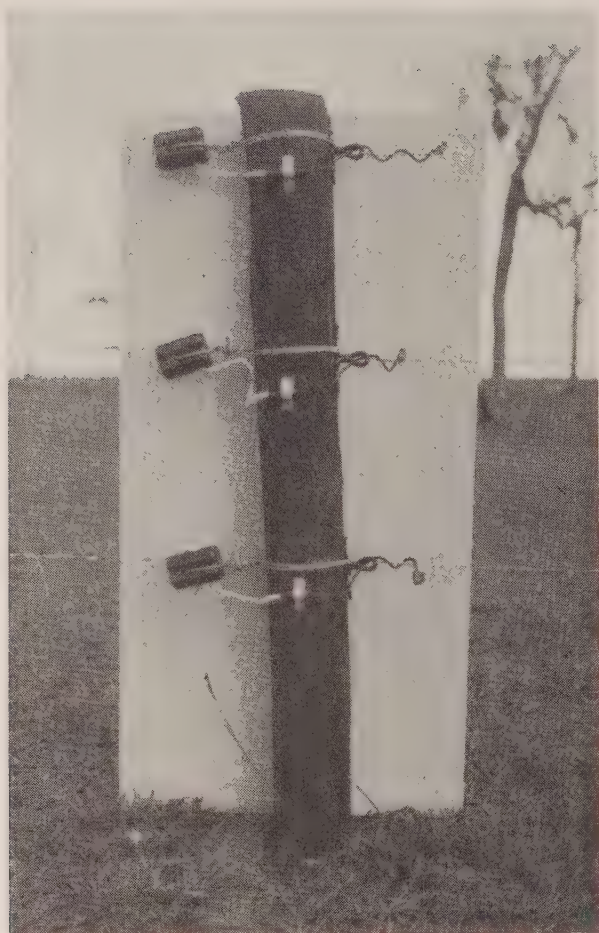
Funds.—The Commonwealth Extension Services Grant provided \$32,500 for the building and furnishings and \$10,000 for initial equipment to set up the centre. Additional equipment funds will be sought in 1969-70 from the same source. Plans and specifications are approaching finality.

Staffing.—It is proposed that the present Agricultural Engineer (Research) Mr P. J. Holligan be Officer-in-Charge of the Centre, and that the following staff be recruited in the first year of operation: one Agricultural Engineer (Machinery and Instrumentation), one Senior Technical Officer (Draftsman), one Senior Technical Officer (Workshop Manager), two fitters and turners, and an office assistant.

1968-69 Engineering and Machinery Officers' Research

Simplified Controlled Atmosphere Generator; Fruit Storage.—The object is controlled atmosphere (CA) equipment to lower costs of units to orchardists. The equipment available for CA storage has cost \$12,000 to \$15,000 per unit installed. A simplified system has now been developed, in co-operation with the Division of Horticulture. It costs \$1,500 to \$2,000 for an average sized orchard and enables the smaller grower to benefit by storing his fruit in CA conditions.

The developed system comprises a simple open flame generator and scrubber and a gas-tight plastic tent ("room"). At present 1,500 bushels of apples are being stored by this means at an orchard near Orange and observations will continue for several months—by means of instruments designed and installed by the Agricultural Engineer (Research). Another plastic-film "room" has been installed at Batlow.



Electric Fencing Research

The Agricultural Engineering (Research) Section has worked into a north coast cattle-grazing project numerous installation ideas for more manageable electric fencing—as an aid to controlled grazing. In this photo: the 3 inch strainer (round) and the “banana clip” connectors to gate.

These plastic “rooms” are gas-tight. Prefabricated in a factory, they can be installed by a grower—without technical assistance. The generator costs about \$650 and could readily be made by some farmers or by small, rural engineering workshops.

Drawings and specifications of the generator and plastic “room” are to be shown at field days at Batlow and Orange in August, 1969.

Rice Harvesting Machinery.—The object is to improve harvesters for rice crops. Headers now available are not designed to handle the heavy-yielding crops produced in the Murrumbidgee Irrigation Area.

The Leeton Agricultural Machinery Officer has investigated the relative merits of harvesting lodged rice crops by the following:

Short crop-lifters attached to knife fingers; long crop-lifters attached to knife fingers; variations of standard pick-up reels; heavy duty crop-lifters attached to header platforms; closed-front headers with pick-up reels; narrow-front medium-capacity headers, with and without heavy duty crop-lifters; extended cutter bars with draper fronts; cutting and windrowing the crop before feeding it into the header.

He made observations at a comparative rice header demonstration at Whitton in April, 1969, and has also undertaken a survey of sixty-two items—to compare the parameters of all current model rice-headers. The results enable reasonable prediction of the likely field performance of the particular rice header under various crop conditions.

Fencing: Electric and New Types.—The object is to improve the technology of electric fencing and to evaluate new types of low cost, livestock fencing. This year 8 miles of low cost, permanent electric fence was designed. It has been erected at Grafton Agricultural Research Station for research purposes. The fence is functioning satisfactorily so far.

Materials have been purchased for further electric fences and new other types of low cost fencing to be erected shortly and assessed in various conditions. Reliability and life of component parts will also be studied.

Mechanization of Vegetable Production.—The Agricultural Machinery Officer at Yanco Agricultural College and Research Station at the request of local growers’ organizations is now studying mechanization of vegetable production in the M.I.A., associated districts, and the Coleambally Irrigation Area.

His reports on equipment within the industry and on mechanization of the carrot, onion, tomato, rock melon, and potato industries are in hand.

Grain Bulk-handling Methods.—Grain bulk-handling methods throughout the wheat belt were studied. A pamphlet outlining various methods of storing grain in temporary storage facilities, the means of filling and emptying these units, and costs and capacities, has been widely distributed.

Grain Storage Sheds.—The Gunnedah Agricultural Machinery Officer continued his studies of grain storage sheds, grain handling equipment, grain drying and screening equipment. As a result he has been able to advise farmers throughout the northern areas—currently a critically important need in view of the looming wheat marketing problems. Elimination of field storage units, and their replacement with grain storage sheds, and trucks for quick field to shed transport, has been widely accepted as the most efficient means of handling large grain harvests.

His designs of grain drying plants also are widely accepted, and forty-five simplified grain screens of his design have been manufactured.

Technology of Grain Aeration.—Not enough is known about the engineering aspects of aeration in farm storage systems. A project designed primarily to study the technology of grain aeration for farm-type silos has been started at Condobolin Agricultural Research Station in association with the Entomology Branch, Division of Science Services.

Various automatic and manual control systems are being compared on the three aerated silos which have been instrumented. The control systems used this year were those advocated by most workers in this field, but have been found unsatisfactory because of grain absorption of moisture. The absorption swelled the grain and considerably increased the pressure on silo walls.

As a result of this work, recommendations can now be made for control and operation of farm aeration systems during the coming season, when farm storage for extended periods will almost certainly be needed.

Orchard Spraying Equipment.—Investigation of orchard sprayers (to control two-spotted spider mite) was needed at Orange this year. The Regional Agricultural Machinery Officer found that existing commercial spraying equipment would satisfactorily control the pest—if used at recommended speeds and when applying the recommended rate of the appropriate insecticide at the right time and interval.

Pear Bruising during Bulk Handling.—A reported 20 per cent mechanical damage in bulk-handling of pears was examined by the Leeton Agricultural Machinery Officer. The finding was that 5 per cent to 8 per cent of pears were damaged by machinery before delivery to the cannery, and that the horticultural faults provided the main reasons for rejection of fruit by the cannery.

Cultivation Equipment for North Coast.—The Lismore Agricultural Machinery Officer conducted a primary-tillage investigation involving five implements, viz. rotary hoe, mouldboard plough, disc plough, heavy offset disc, and a combination of chemical spray and chisel plough. Although this year’s abnormally dry conditions affected the work, it yielded useful engineering and costing data on primary tillage equipment commonly used for the heavy soils in the area.

Banana Washing and Waxing Plant.—Improved mechanization of banana washing and packing plants and better banana packing house layouts are needed. Studies were made at Brisbane and in the Lismore and Coffs Harbour districts. A new commercial-type plant has now been installed at the Tropical Fruit Research Station, Alstonville, and is being assessed.

Tyne Point Wear Rates.—The object is to devise tyne points to wear longer and reduce the power needs for tillage. Metallurgists of the leading steel merchants have been consulted, towards finding a steel with better wearing qualities than that currently made into tynes and sold in New South Wales.

A special cast-steel point with long-wearing qualities has been designed for testing in North Western Region. Hard-surfacing welding techniques have been studied in association with metallurgists and research engineers of leading welding companies. As a result, some type points were procured and hard surfaced, and are now being tested in Southern Region.

Power Needs for Tillage.—This project aims at providing material to enable farmers to match their field equipment to the size of their tractors on a scientific basis. Equipment has been designed and purchased for assembly. It will be completed at the Agricultural Engineering Centre then used at selected places in tests on the draft requirements of field implements and the tractive performance of tractors.

Design of Research Equipment.—Engineering design assistance was given towards a multipoint measuring system to monitor temperature at various positions in a research potato storage building. Also, equipment was designed and built to effect a wide range of temperatures of soil in pots—including predetermined diurnal temperature variations.

AGRICULTURAL MACHINERY OFFICERS' EXTENSION AND ALLIED WORK

The Agricultural Machinery Officers in Regions did situation analyses for the respective Region and, from these, prepared their programme and work plans.

Rice Harvesting; Example.—One programme focused on the level of overall field and harvesting losses in rice crops (estimated in the preceding year to have been about \$2,000,000). Forty acres of rice were sown on the Whitton Race Course and, at harvesting, nine header firms at a field day demonstrated their machines in various densities of crop. Performance of each header was assessed by the Agricultural Machinery Officer and a committee comprising local growers. The assessments, compiled into a report, were distributed to the manufacturers for their confidential information.

In the 3 months before the harvest 24 radio broadcasts and three television presentations were made on the subject; one school was held on setting up rice headers; one demonstration was held to demonstrate use of crop lifters in lodged and tangled crops; three meetings were held on rice header efficiency. Articles on rice harvesting were published; one in *Power Farming and Better Farming Digest* ("Rice Headers Inadequate for Tough Harvest") and one in the *Farmers' Newsletter*, Large Area Edition ("Harvesting Lodged Crops").

The Leeton Agricultural Machinery Officer has since been asked to address senior engineers of two Victorian manufacturers of rice-headers. Also, by invitation from the Queensland Department of Primary Industries, he visited ricegrowers in the Ayr-Bowen district to assist in their rice harvesting problems and conduct two rice harvesting schools there.

Volume and Range of Extension.—The Agricultural Machinery Officers report a steady volume of inquiries needing to be handled on a personal basis. These came from individual farmers, farmer organizations, dealers, and trade houses. One officer reported attending to 777 inquiries (through 233 property visits, 289 interviews, and 255 telephone discussions—about 100 of the latter outside office hours).

The wide range of inquiries, many of them complex and difficult, is a problem facing each officer—the problem of answering inquiries over the whole spectrum of agricultural engineering and farm machinery. The officer at Orange has listed 113 different topics whereon advice was sought of him this year.

There were increased inquiries from farm machinery companies and dealers, indicating the acquired status of the Agricultural Machinery Officers in the industry.

Radio and Television.—Wide use was made of radio by the five Agricultural Machinery Officers. This year over 300 separate tapes were prepared and many of these tapes were used by several radio stations. In the South Western Region, the machinery officer provided different tapes for three regular weekly programmes throughout the year, for different radio stations in various parts of the region. Also, twelve telecasts were made—"Rice Harvesting", "How to Prevent Bruising of Bulk Handled Fruit", "Grain Handling", "Grain Drying", "Farm Safety", and others.

Newspapers and Journals.—The rural press published eighty-eight different articles from the various machinery officers. The officers provided special articles for the city-based rural newspapers, for the latter's Farm Machinery Supplements, as well as for their own local newspapers' special editions featuring farm machinery.

The rural press widely publicized an article on "Grain Storage and Grain Handling Techniques" jointly produced by one of the machinery officers and the Agricultural Engineer (Research). The magazine *Power Farming and Better Farming Digest* also published that article, and an article "Rice Headers Inadequate for Tough Harvest" by another machinery officer. The Central Coast *Research and Extension Newsletter* printed an article "Maintenance of Orchard Sprayers" by the Agricultural Engineer (Research). The I.R.E.C. *Newsletter* published an article "Harvesting Lodged Rice Crops" by a machinery officer.

Field Days.—The programme (an extension medium by design) for the Australian National Machinery Field Days was compiled by the Orange Agricultural Machinery Officer, including a farm machinery catalogue and extension reference material—192 pages in all. Over 3,500 of these programmes were sold. The extension contents included drawings for permanent wheat storage layouts, temporary grain storage installations, and control atmosphere storage units. The Australian National Field Days at Orange drew an attendance of 25,700 this year. There were 182 exhibitors and more than 400 separate comparative field demonstrations of farm machinery over the four days.

Agricultural machinery officers participated in forty-two field days and farm machinery demonstrations.

In North Coast Region four machinery field days, with a total attendance of 2,450, featured comparative demonstrations; two on pasture improvement machinery and two on maize row-crop machinery. The Lismore Agricultural Machinery Officer had a major role in the organizing.

In South Western Region a major rice-header field day (mentioned earlier, under "Research") was organized by the Leeton Agricultural Machinery Officer and the Irrigation Research and Extension Committee. About 600 people attended. Nine header firms provided comparative demonstrations, enabling farmers to compare the operations under farm conditions.

In the North West a Wheat Machinery Field Day at Moree, and other machinery field days in this Region, drew about 800.

Agricultural Shows.—The Agricultural Machinery Officers did extension work at several agricultural shows. The Wagga officer played a big part in organizing machinery displays at the Wagga show and assisted at Henty, Batlow, Jingellic, Cookardinia, and Marrar machinery field days.

Schools and Meetings.—Talks were given at fifty-seven meetings and schools on a wide range of farm machinery subjects. Tractor Maintenance Schools were held at five centres, in districts remote from centres of Technical Education, and totalled 257 in attendance. Welding Schools were held at seven centres with a total attendance of 118, but limited by need to ensure good instruction.

Talks and demonstrations were given at meetings of the Agricultural Bureau, Rural Youth Clubs and other farm organizations in various parts of the State. A Wheat Mechanization Seminar at Moree drew more than 100 people.

Effects of Study Tour by Agricultural Engineer.—The report of the Agricultural Engineer on his overseas study tour was printed and distributed strategically to key-places and libraries. The Agricultural Engineer gave talks, based on the study tour, to the Division of Plant Industry District Agronomists' Conference, the M.I.A. Irrigation and Extension Research Committee, the Agricultural Engineering Society of N.S.W., the South Western Region Extension Officers' Conference, and the Agricultural Engineering Society Symposium on Wheat Mechanization at Moree.

DIVISION OF PLANT INDUSTRY

General

PROFESSIONAL STAFF

Senior Staff Changes

On 16th August, 1968, Mr W. H. Poggendorff, Chief of the Division since 1947, retired. He was succeeded as Chief by Mr A. C. Orman, previously Deputy Chief. Mr L. R. Kavanagh, previously Principal Agronomist (Research), became Deputy Chief and his previous position was filled by Mr K. R. Green who relinquished the position of Principal Agronomist (Weeds). Mr J. Strang, previously Special Agronomist (Seed Production), became Principal Agronomist (Weeds). The Special Agronomist (Seed Production) position was taken over by Mr J. H. Ballard who had been Assistant Principal Agronomist (Research). The latter position was still vacant at 30th June, 1969.

Another important promotion was that of Mr D. E. Wallin, from Assistant Principal Agronomist (Irrigation), to the vacant position of Principal Agronomist (Irrigation).

Professional Staff Situation

At the start of 1968-69 there were 169 established positions in the Division of Plant Industry; eleven vacant. At the end of the 12 months there were 171 established positions; twelve vacant. Eight of the twelve vacancies were research positions. Two research positions in plant breeding, two in tobacco agronomy and two in weed science have been vacant for periods ranging from six to 18 months.

The net gains for this year were two in establishment and one in the number of filled positions. The gain of one in filled positions was the net effect of the following: recruitment of twenty new officers (twelve University graduates and eight College diplomates), plus one transfer from another section of the Department and one officer returned from National Service training; less twelve resignations (five graduates and seven diplomates), two retirements, one transfer to another section of the Department, two secondments to other sections of the Department and four officers entering National Service training.

At 30th June, 1969, the Division had twenty-five positions in head office and 146 in rural areas. Of the 146 rural positions, seventy-four are research and seventy-two are extension positions.

Whilst five new positions were created (three in extension and two in research), three positions were deleted. Thus the net gain of two in establishment. One of the deleted positions was that of Assistant Principal Agronomist (Irrigation), Griffith, for which was substituted a position of District Agronomist, Griffith. The two other deletions were pasture research positions at Grafton and Glen Innes Agricultural Research Station. These were deleted because of a lack of funds previously provided by the Meat Research Committee.

Of the five new positions, four were financed from Consolidated Revenue funds and one from the Commonwealth Extension Services Grant.

Effects of Industry Funds on Research Establishment

Industry funds continued very helpful in maintaining an expanded research programme in certain directions (pasture, wheat, tobacco research). But contraction of some of these funds, because of drought affecting contributions, caused support for the salary of one additional research agronomist to be withdrawn at the end of the year. Fortunately, because of other financial arrangements, it was not necessary to delete that position.

Industry support continued for fifteen research agronomists' salaries. Another six research agronomists, with Wool Research Trust Fund support, are undertaking 3-year training studies with the CSIRO. Regional farmer groups, mainly coastal, have also made important contributions to research programmes.

Effects of C.E.S.G. Funds on the Research Establishment

Commonwealth Extension Services Grant funds also continued to support research, providing the salaries of four research officers. Other assistance from this source declined rather, due to the large proportion of the annual total received by the Department being committed to salaries and major capital items.

District Agronomist Positions

At the start of 1968-69, six of the established forty-five District agronomist positions were vacant. Seven more became vacant during the year; one by retirement, three by resignation and three by transfer of officers to other positions. Also, two new Districts were created this year; Coleambally and Coonamble. Thus, fifteen District positions needed filling within the twelve months.

Of the fifteen vacancies, twelve were filled by trained officers. Eleven were products of the In-service training programme, and one had returned to the Division from secondment. At the close of the year three Districts remained vacant but arrangements were in hand for appointments to them.

Post-Graduate Study and Training

Research Agronomists.—As at 30th June, 1969, five research agronomists were engaged in Ph.D. studies at Australian and U.S.A. universities.

Four agronomists completed a period of three years in co-operative research and training with the CSIRO in Canberra and have now resumed research positions within the Division. Another four newly appointed agronomists started on similar projects in Canberra and Armidale with the CSIRO and, with two others continuing, there were six agronomists engaged in co-operative research and training with the CSIRO at the 30th June.

Two other officers were on secondment to the CSIRO Irrigation Research Laboratory, Griffith, for training in irrigation research and one for training in plant physiology. Another was on secondment to the University of New England for research into bloat of beef cattle.

Including the ten agronomists who have been in training with the CSIRO, twenty-two officers were registered as Masterate students at various universities in New South Wales.

Extension Agronomists.—One District agronomist returned to duty in December, 1968, after completing the Post-Graduate Diploma Course in Agricultural Extension at Melbourne University on funds from the Wheat Industry Research Council. Two others commenced similar courses in February, 1969, one each at Melbourne and Queensland University, on funds respectively from the C.E.S.G. and the Wheat Industry Research Council.

Two District agronomists completed by external courses the B.A. Degree at the University of New England and seven others are undertaking external degree courses through that University, while two are doing similar courses through Macquarie University.

Overseas Study Tours

Principal Agronomist (Weeds).—This officer spent nearly four months in North America and Western Europe visiting Government, University and private institutions. The tour was financed from C.E.S.G. funds. He studied the organization and facilities for weed research, the development of research-extension liaison, and extension programmes specifically aimed at weed control. He contacted also the appropriate administrative and regulatory authorities on noxious weed legislation, herbicide registration and problems of herbicide drift and environmental pollution. His detailed report is being prepared.

Assistant Principal Agronomist (Vegetables).—From July to November, 1968, this officer engaged in a tour of overseas countries to investigate potato research and production in major research centres. He attended conferences of the Potato Association of America, the Potato Utilization Committee of America and the Potato Genetics Project Committee. At each of these he presented papers by invitation. He visited research centres in northern U.S.A. and in Canada, Ireland, Scotland, England, Holland, and India. The emphasis of his studies was on recent developments in potato breeding and genetics, research into tuber quality and processing, and seed production.

Finance for his tour was provided by the potato industry in each State, the Commonwealth Government, and the C.E.S.G. Subsequently, he visited each State in Australia to inform potato growers and research personnel of the results of his tour. His full report is being prepared.

PROGRAMME PLANNING

For Research.—Programme and work plan, including a review of achievements during the past year, have again been developed in respect of each research agronomist. The procedures have partly achieved the objectives but it is apparent that not all officers yet appreciate the value and methods of this approach.

For Extension.—An extension programme and work plan were formulated by most District agronomists. In Districts that were vacant in the year the officers who went there were guided in their approach by head office Principal Agronomists and the respective Regional Supervisor.

A programme and work plan were prepared and executed in thirty-five Districts. They aggregated 116 objectives, concerned with: increased cereal production, 7; increased efficiency of cereal production, 12; increased pasture and lucerne acreage, 18; increased efficiency of pasture utilization, 9; maize and sorghum production, 6; forage crop utilization, 8; weed control, 3; adult education, 4; irrigation efficiency, 2; formation of Agricultural Bureau, 2; fodder conservation, 1; vegetables, 1; rice, cotton, and oil crops, 2; and miscellaneous, 41.

An interim review of each programme followed by amendment where necessary was done in October, 1968, and a full review plus a progress report was made in April, 1969. Briefly, it can be stated that the planned programmes had considerable beneficial impact. To measure the success of extension efforts is not easy.

Without doubt, the considerable activity aimed at improving efficiency of wheat production resulted in increased fertilizer use in several districts. There was also substantial increase in lucerne acreage. Wheat and other cereal grain production showed an upward swing. In general there was an improvement in cultivation and management practices with row crops such as sorghum and maize. There was only a moderate increase in forage crop acreage but there was a definite improvement in utilization practices.

The modest increase in tropical pasture acreage was in itself a success, because very adverse seasonal conditions in the areas concerned limited the possibilities of this increase and also of the increase in other improved pasture acreage. Those conditions also affected the planned programmes aimed at improving pasture utilization.

The April, 1969 review of programmes brought out some points influencing the programmes for 1969-70, the main ones being:

- (a) Emphasis will be off the increasing of cereal grain production, particularly wheat, and placed on efficient production.
- (b) Greater emphasis will be on livestock enterprises. An attempt will be made to increase feed production by stressing the value of lucerne, forage crops, and increased pasture sowings.
- (c) In appreciation of the benefits to be derived by officers of various disciplines and the farming community, co-operation between agronomists and livestock officers in formulating their extension plans will be maximized.
- (d) Increased emphasis on the efficiency of pasture utilization by grazing animals.

Some selected extension objectives giving an indication of the broad spectrum covered by District agronomists are:

- (a) A survey of the Ashford Shire, with involvement of the Shire Council, to determine the problems of the area and likely avenues for improvement. This survey has been completed and is ready for computer analysis. A side effect is that an adjoining Shire is willing to assist in a similar survey of its area.
- (b) To increase *per acre* wheat production, based on the economic application of fertilizers as indicated by results of the Central West Wheat Nutrition Research project. (A survey in 1968 indicated that 59 per cent of farmers in the area are aware of the research results and, of these, 74 per cent have increased their rate of phosphate fertilizer application and 48 per cent their use of nitrogen fertilizer.)
- (c) Problems in the development of light soil country in part of northern New South Wales, together with the substantial capital requirement for successful development, have been highlighted in a co-operative programme. Trials and pasture demonstrations are in progress, towards showing more economic means of development.
- (d) In the Mid Coast and Hunter Region a long-term project was laid out (covering a 5-year period of education of farmers, dairy factory managers, bankers, agents and others) towards improving the development of the Dungog Shire.

Emphasis on working with groups of farmers rather than with individuals seems to be increasing amongst the District agronomists and other affected officers.

Surveys are being done by more officers than formerly, reflecting their effort to get as complete a picture as possible as to the state of development, the receptiveness of farmers, etc.

Evaluation of their programmes definitely has the interest of District agronomists but they are unable to fully exploit their interest in this because of the many other demands on their time.

The 1969-70 programmes of planned extension have been prepared, and in many instances meetings have been held with representatives of farmer organizations whereat the plans have been discussed. Amendments have been suggested in a few cases and accepted, but generally the farmer representatives feel that the agronomists and their colleagues are planning their work to meet the most important needs.

DISTRICT AGRONOMISTS' CONFERENCE

The biennial District Agronomists' Conference was held at Hawkesbury Agricultural College in September, 1968.

SOME ACTIVITY STATISTICS OF DISTRICT AGRONOMISTS

On average, each District agronomist worked 227 days; 70 days in the office, eighteen days in attendance at conferences and schools, and 139 on field work which included advising on pastures and crops, the conduct of trials, servicing field days, land settlement and farm water supply inspections, seed production matters, farm competitions, and agricultural shows.

District agronomists on average conducted seven field days with a total attendance of 310 over the seven occasions; six meetings (attendance 142); made twenty-seven radio broad-

casts and one television appearance; and issued twenty-one press statements. Their aggregate activity in these fields comprised:

Field days	269; attendance 12,577
Meetings	213; attendance 4,915
Radio broadcasts	1,043
TV appearances	34
Press statements	814

By comparison with their previous year their total of Field Days and Field Day attendances greatly increased; their meetings and the meeting attendances were fewer; their radio broadcasts and press statements greatly increased but their total of TV appearances was almost halved.

PLANT EXCHANGE

Seed introductions from overseas sources totalled 398, and 487 samples were sent to overseas research workers.

Cereals Work

WHEAT

Record Acreage and Grain Production

In 1968-69 a record wheat acreage was sown. Grain production also was a record.

Of the estimated 10,173,000 acres sown for all purposes, about 9,959,000 acres were sown for grain. Estimated total grain yield was 215,119,000 bushels. Yield per acre sown for grain averaged about 21.6 bushels per acre. An estimated 200,000 acres (about 2 per cent of the total grain acreage) was sown under irrigation in 1968-69; an increase on the previous year.

Grain was clean and of good appearance. Protein content and bushel weight, though lower than in 1967-68, were satisfactory and above average.

Deliveries in N.S.W. to the Australian Wheat Board as at 21st June, 1969, totalled 196,211,000 bushels, of which 194,284,000 bushels were in bulk and 1,927,000 bushels in bags. Some 148,900,000 bushels were classed as F.A.Q.; 31,331,000 bushels commanded a premium, and 15,980,000 bushels were classed as off-grade. Of the deliveries in N.S.W. to the Wheat Board, 74,359,000 bushels came from the Northern Zone and 121,852,000 bushels from the Southern-Western Zone.

In addition to the above receipts, about 8,394,000 bushels of New South Wales wheat were delivered in Victoria to the Wheat Board, from the southern New South Wales stations operated by the Victorian Railways. This brought to 204,605,000 bushels the total receipts of N.S.W. wheat by the Australian Wheat Board. The rest of the harvest was held back on farms for seed, feed, or later delivery to the Wheat Board.

At the start of the 1969-70 sowing season, growers' sowing intentions would have resulted in a further record acreage. An excellent early seasonal break provided good starting conditions for the crop, but above average early winter rains and the announced imposition of quotas on grain deliveries for the 1969-70 harvest have reduced the intended sowings.

Premium Wheats

Local premium wheat payments by millers reached only \$133,857 (to 28th February, 1969). The 1,726,502 bushels concerned included 960,954 of soft varieties and 602,919 of hard bread-wheat varieties (Australian Wheat Board figures)—the lowest quantity of hard varieties for many years. In the previous season, premiums of \$159,503 were paid, on 1,845,804 bushels of soft and hard wheats.

This year 45,706 bushels of the durum wheat variety Dural drew premiums.

Premium average paid for hard bread-wheat varieties was 7.53 cents per bushel; for soft varieties, 4.44; and for durum, 28.1 cents.

Highest premium average per bushel for individual varieties was paid for Dural (28.1 cents); for the hard bread-wheat varieties the order was Gala (10.29 cents), Gabo (10.09 cents), Gamut (8.6 cents), and Festiguay (8.3 cents).

The most popular hard bread-wheat varieties as gauged by local premium acceptance quantities were Mendos (35.7 per cent, Gamut (21 per cent), and Timgalen (14.1 per cent).

Pinnacle (82.5 per cent) and Heron (8.8 per cent) accounted for 91 per cent of the soft variety deliveries for which local premiums were paid.

Besides the aforementioned quantities, 29.4 million bushels of wheat tested for protein were received at selected receival points in New South Wales for eventual sale to local and/or overseas buyers.

Wheat Quality Standards

For the 1968-69 harvest, five standards were declared by the New South Wales F.A.Q. Standards Committee, viz. prime hard, lightweight prime hard, Northern F.A.Q., Southern-Western F.A.Q. and New South Wales off-grade.

The standard for prime hard wheat (mainly from northern New South Wales) was declared at 61 lb per bushel Schopper weight (14.8 per cent protein); and light weight prime hard 58 lb per bushel (15.4 per cent protein).

For Northern F.A.Q. (related to wheat to be exported from Newcastle) the standard was declared at 62½ lb per bushel (12.8 per cent protein); and the standard for Southern-Western F.A.Q. (related to wheat to be exported from Sydney) was declared at 63½ lb (11.8 per cent protein).

New South Wales off-grade was declared 58 lb per bushel (13.4 per cent protein).

Weighings were made on the official Schopper scale which normally records weights of up to 1½ lb higher than those recorded on the Franklin Chondrometer.

For comparison, it is pointed out that the 1967-68 prime hard wheat was declared at 62½ lb (wheat protein 15.7 per cent on a 13.5 per cent moisture basis); Northern F.A.Q. at 64½ lb (wheat protein 13.7 per cent); and Southern-Western F.A.Q. at 64 lb (wheat protein 13.5 per cent).

The prime hard grain sample from the harvest just completed was uniformly hard in appearance. The light weight prime hard sample was hard looking and, though somewhat pinched, was of good quality despite its low bushel weight. The Northern F.A.Q. grain sample was attractive and predominantly hard. Its protein level, though lower than the previous year's, was the second highest recorded since the Northern F.A.Q. was first declared. The Southern-Western F.A.Q. was a mixed, predominantly soft, sample. Its protein content, though less than the previous year, was at a satisfactory level and well above average.

Wheat Variety Popularities

Variety statistics for the 1967-68 season show that the previous leading three varieties—Heron, Falcon, and Olympic—maintained their positions. Heron increased its percentage area slightly while Falcon and Olympic fell slightly.

Mendos increased its percentage area and became the fourth most popular variety, displacing Gamenya from that position. The most spectacular increase in popularity was achieved by Gamut. It increased from 2.7 to 9.0 per cent of the total area and advanced from ninth to sixth place. Festiguay's percentage of total area increased from 5.9 to 7.4 per cent, although it fell from sixth to seventh place. Glenwari and Mengavi fell from seventh and eighth to ninth and tenth place respectively.

Wheat Variety Recommendations

The only change made to the previous recommendations is the deletion of Bordan in favour of Pinnacle. Trials over a number of years have shown that Pinnacle is superior in yield to Bordan and stronger strawed. Even so, Pinnacle's yield is still well below that of Olympic. Pinnacle is a special purpose variety, for sowing very early in the season (early to mid-April) when there could be danger of serious stem frost damage if Olympic were sown.

Winter Wheats

Lack of effective late summer/early autumn rains for 1968 resulted in a lower acreage being sown to winter wheats than when in the previous year (1967-68) the Departmental winter wheat varieties Winglen and Windebri were sown on 89,257 acres, mainly in the north. In some northern localities, where early rain was enough for establishment, winter wheat was sown mainly for grazing. Grain yields per acre were above normal because few crops were heavily grazed.

Durum Wheats

All durum wheat grown commercially in New South Wales is of the Department's variety Dural. It is grown in the northern part of the State.

About 180,000 bushels of Dural were harvested, as against 100,000 bushels in 1967-68. All, except grain held for seed, sold at premium prices. Premiums amounting to \$45,706 were paid by local millers on 162,629 bushels of Dural, a premium average of 28.10 cents per bushel. The premium average paid for Dural was higher than for any other wheat in 1968-69. Durum sowings of 10,000 acres or more are estimated to have been made in 1969.

New dwarf durum crossbreds, evolved in the Northern Departmental Wheat Breeding programme centred at Tamworth, were again tested in 1968. One of these (No. 2030) has given good results in field and quality tests and will be submitted for registration as a possible replacement for Dural.

The first bulk export of durum wheat from Australia was shipped to a miller in Kuwait in early 1969. Kuwait has indicated a desire for a continuing source of this wheat. A Tamworth milling firm is arranging contracts with growers so that future supplies will be regular.

Wheat Quality

The Chemistry Branch co-operated in the quality assessment of new wheat varieties under test on Research Stations and on co-operating farmers' properties. About 800 samples were supplied for testing. Also, uniform quality testing of a number of promising crossbreds was done by collaborating laboratories.

Following tests on the crossbred A.R. Falcon 28A the State Wheat Improvement Committee agreed to proceed with an application for naming and registration. Depending on final yield and quality tests, one or more other lines may later be considered for release.

The Cereal Specialist judged the bench characters of wheat in the open classes at the 1969 Royal Easter Show. Seventy-one samples were entered, compared with ninety-four in the previous year.

Best samples in the main classes were of a very high standard but, in general, quality on the bench was mediocre—particularly in appearance and uniformity. Top bushel weights were for samples of Spica and Heron, each weighing 68½ lb per bushel. Best entries on the bench in their appropriate classes were, in order: Falcon, Heron, Spica, and Festiguay. Each of these except Spica is a Departmental-bred variety. Durum and biscuit wheat classes were not included in this year's schedule.

Of the twelve varieties included in the samples received, order in popularity of entry was: Gamut (15), Timgalen and Olympic (10 each), Falcon and Gamenya (6 each), Spica, Festiguay, and Heron (5 each), Mendos (4), Robin and Winglen (2), and Windebri (1).

Wheat Experiments

Variety Trials Statistics.—The 1968-69 randomised and replicated wheat variety trials were arranged with ninety-eight farmers (78 in 1967-68) working under the supervision of 29 (22) District agronomists and testing a total of 22 (18) varieties. Also, wheat variety trials were conducted at seven Research Stations. A large number of promising crossbreds and new varieties were tested there and compared with standard varieties.

Despite the dry spell in early spring, in many areas, a very high proportion of trials were successfully harvested. The total of trials harvested was 124, as against 95 in 1967-68.

New Wheat Varieties' Performances.—In northern New South Wales new ones under test included Timgalen and 8127-266. The dry spell in the early spring showed up the good drought-resistance and adaptability of Gamenya. Timgalen yielded poorly; inferior to the other standard varieties. 8127-266, a crossbred developed at Tamworth Agricultural Research Station, compared favourably with the northern standard varieties. Interestingly, AR Falcon 28A, developed at Temora Research Station in southern New South Wales and resistant to all prevalent strains of stem rust, was superior in yield to Timgalen, Festiguay, Mendos, and Glaive (from South Australia) and equal to Gamut in northern trials.

In central and southern New South Wales, new varieties tested included Wren, Timgalen, Robin, AR Falcon 28S, Summit, M1238-2, and M1224-2. Despite the dry spring, Wren compared more than favourably with Olympic but its margin of superiority was much less than in the very good season of 1966. Wren (formerly known as NB Javelin 115) was named in 1968 and submitted for inclusion in sowing recommendations but this was not agreed to because of slightly inferior milling quality. The northern wheat Timgalen proved to be greatly inferior in yield to the standard varieties. Robin was about equal to Heron. Summit was much superior to Pinnacle and about equal to Olympic. Glaive was tested extensively for the first time but did not yield impressively. AR Falcon 28A proved slightly inferior in yield to Falcon but its complete resistance to stem rust more than makes up for that difference.

This variety has been submitted for registration. M1238-2, a promising early, strong strawed, semi-dwarf variety compared favourably with Gamenya and Robin. However, M1224-2, a midseason line, was disappointing in comparison with Olympic.

Soil Fertility and Rotation Experiment.—This completed its 13th year. It has now been terminated for reasons recorded elsewhere. Not least of these was that the inflexible nature of the rotation experiments necessitated the continuance of varieties, rates of seed and fertilizer and other practices long after they were proved obsolete.

Although the findings from the experiment are of limited value, several trends have been apparent: 1. An indication that the soil nitrogen depletion noted in all treatments was less in the rotation which included 5 years of lucerne, as compared with continuous wheat. 2. Some evidence of depression of wheat yielded after lucerne in dry years (observed also in trials in Victoria and Queensland, and in another experiment at Condobolin Agricultural Research Station). 3. Effectiveness of 2,4-D as a herbicide against skeleton weed in the cropping phase. 4. When conditions are favourable, wheat grown after a period of lucerne appears to give increased yields.

Irrigated Wheat Research.—The research agronomist now on this project took up duty in July, 1968; too late to organise and sow trials for the 1968-69 season. But trials were sown in 1969. These will compare rates of gypsum, frequencies and duration of irrigation, cultivation treatments and seeding rates.

Wheat Fertilizer Trials.—For the 1968-69 season seven wheat variety x fertilizer interaction trials were sown in the northwest. Six varieties (Mexico 120, Gamut, Mendos, 8127-266, Festiguay and Timgalen) as well as half-sowing rates of Gamut and Timgalen were included. Four nitrogen and four superphosphate rates were used.

No yield response to nitrogen was obtained, in fact in a few trials there was a yield depression with high nitrogen (100 lbN/acre). In most trials there was a response to phosphorus. At all sites, Mexico 120 outyielded all other varieties. The half-sowing rates of Gamut and Timgalen in some cases equalled the yield of the full-sowing rates but in other cases yielded less.

The central western wheat nutrition programme based on Condobolin Agricultural Research Station has now completed its fifth year. Some trials were sown in April, 1968, but few in May—the main sowing month in most seasons—because of continued wet weather. The remainder of the trials were sown in June.

Despite the excellent start to the season, dry weather in September and October caused rapid deterioration in yield prospects and the harvest results closely approximated those of an average season. Results from the trials mostly confirmed the fertilizer responses obtained in earlier years.

In the eastern part of the Central West, with headquarters at Cowra Research Station, wheat fertilizer trials were conducted for the fourth year. The total of trials sown was less than intended because of excessive rain at the sowing period. On the other hand, the effect of the dry spell in the spring was less severe than in western areas—so yields were reasonable.

Further extension of the Central Western Wheat Fertilizer Programme, by locating a research agronomist at Trangie Agricultural Research Station, led to a full-scale sowing in the northern part of the area. Although the dry spring adversely affected many of these trials, most were harvested and gave significant results.

Phosphorus-response was general throughout the central west, with needed rate depending on soil type and previous history. There were some responses to low rates of nitrogen in western parts but none was recorded in the more easterly higher-rainfall areas around Cowra where subterranean clover flourishes.

Wheat belt fertilizer practices continued to change; with accent on higher rates of phosphorus, and increasing use of nitrogen, and high analysis fertilizers.

Field Wheat Competitions

Seven divisional Dryland Championships were conducted during 1968 by the RAS. Most of the local and all of the Championship judgments were done by Department of Agriculture officers. Crops judged totalled 873; in eighty-eight local competitions. In 1967 there were 628 crops, in seventy-three local competitions; and in 1966 there were 957 crops in eighty-three local competitions.

The following statistics for the 1968 Dryland competitions are of interest:

Division	Local competitions	Local entries	Championship crop	
			Variety	Yield Bush./acre
Northern	11	95	Gamut	51
Northern Slopes	15	184	Gamut	60
Western	17	204	Falcon	45
Central Slopes	13	117	Gamenya	49
Central Tablelands	4	29	Olympic	47
Riverina	15	131	Olympic	47
Southern Slopes	13	113	Olympic	59
Total	88	873		

Besides the Dryland competitions the RAS in 1968, for the second year, promoted a series of Irrigated Field Wheat Competitions. These were conducted by five societies, in three Divisions. The Department advised the RAS on judging procedures, scale of points, etc., but was otherwise *not* associated with judging these irrigated competitions. Following are details of the winning crops:

Division	Entries	Winning crops		
		Variety	Locality	Yield Bush./acre
Northern	4	Timgalen	Walgett	66
Central Slopes	11	Festiguay	Hillston	50
Southern Slopes	15	Pinnacle	Deniliquin ..	51

Because irrigation water supplies were drastically restricted in the early months of 1968, no irrigated competition crop was grown on pre-irrigated land. Of the thirty entries in the Irrigated Field Wheat Competitions, twenty-five were withdrawn before judging.

OATS

Acreage and Production

Despite dry weather in late spring, 1968, the 1968-69 oat crop was estimated to be third from highest on record, though well below the record 41,000,000 bushels obtained in 1966-67. An estimated 27,315,000 bushels of grain was obtained from a harvested area of about 1,184,600 acres, at a yield average of 23.1 bushels per harvested acre.

Hay production was estimated at 258,000 tons, from about 156,000 acres, at a yield average of 1.7 tons per harvested acre.

Total sowings for all purposes are estimated to have reached 2,125,700 acres; 785,200 acres were utilized for green fodder.

In the previous season (1967-68) only 8,235,000 bushels of grain were produced, from a sown area of 907,000 acres, at a yield average of 9 bushels per acre. Total sowings for all purposes in that year were 1,811,000 acres.

Though delayed a little by lack of rain, the 1968 oat sowings had a good start in most areas because of satisfactory autumn rains. Prospects, good in most districts during the winter, suffered because of the rather dry spell—except in the irrigated areas and the southwest where rainfall in October helped crops along. Crops in general finished better than expected.

Oat Variety Popularities

The only changes in order of variety popularity were the advance of Acacia from tenth to eighth place and Dale's fall from eighth to tenth place.

Cooba, leading variety since 1964-65, increased its share of the total area from 29.4 per cent to 33.1 per cent. Belar decreased from 11.2 per cent to 9.9 per cent of the total area, and Algerian dropped by 1 per cent compared to the previous year. Fulghum, Orient, Dale and Ballidu also declined slightly in percentage area, but each by less than 1 per cent. Avon and Acacia maintained their percentage.

Oat Variety Recommendations

The only new variety added to recommendations is Saia. This variety should be of use for early and late sowings for green feed production on the coast but it is not suitable for other areas. Its main features are quick production of early feed, good recovery from grazing, moderate resistance to frost injury, and good rust-resistance.

Because of inferior grain quality and yield, Saia will not be available from registered seed growers in New South Wales. Its seed is usually available from north coast or Queensland seed merchants.

Two varieties, Lampton and Orient, have been withdrawn from recommendations. Lampton, recommended previously only for spring sowing for grain production on the northern and southern tablelands, has proved to be inferior to Garry. Orient, suitable for late sowing for grazing and grain, or grain only, in the lower rainfall districts, has been withdrawn in favour of Coolabah.

Oat Experiments

Variety Trials Statistics.—In 1968, replicated Oat Variety Trials were sown on the properties of fifty-six farmers (sixty-three in 1967–68) under the supervision of twenty-nine (twenty-five) District agronomists who tested a total of twenty (seventeen) varieties. Also, Oat Variety Trials were conducted at eight Research Stations. A large number of promising cross-breeds and new varieties were tested against standard varieties in these trials.

Oat Variety Performances.—Avon x Osage M1255, the Temora Research Station crossbred, compared well with Avon; quick early feed, with a high grain yield, and usually superior to Avon overall. It is being submitted for registration.

The 1968 conditions favoured early maturing varieties. Among the grain varieties, Avon was the best yielder. It was followed by Orient, and then Bundy and Fulmark (about equal). Of the grazing varieties, Coolabah and Bundy were outstanding. They were followed by Orient, then Cooba and Fulghum.

Irwin and Swan, two introduced varieties from Western Australia, were not impressive when compared with Avon and Coolabah. A promising New South Wales crossbred (P4315) from Glen Innes Research Station was inferior to Avon and Coolabah but equalled Cooba.

Seed and Fertilizer Rates, for Grazing Oats.—A factorial trial to determine effects of nitrogenous fertilizer on green forage production and grain recovery (two rates of sowing, four rates of nitrogen, and two times of application) was again conducted at Glen Innes Research Station. A basic treatment with superphosphate 1 cwt/acre was supplied to the site.

Because of adverse seasonal conditions the trial was not sown until the end of March. Inadequate and poorly spaced rainfall prevailed during the season. Only one grazing cut, in mid-September, could be made. The best results, for both grazing and grain were from treatments with high seeding rate and high rates of nitrogen.

Oat Improvement in Northern N.S.W.

An oat breeder was appointed to Glen Innes Research Station early last year. He recommended the programme which had been in abeyance for just over three years. Most of the old material was sown. Observations during the growing season were followed by selections at harvest. Unfortunately the breeder resigned from the Department at the end of the season, and it has not yet been possible to replace him.

BARLEY

Acreage and Production

The 1968–69 area sown for all purposes totalled 548,400 acres, and 486,100 were for grain. Grain production was 11,186,700 bushels (6,273,500 of two-row and 4,913,200 of six-row types)—more than double that of the previous year, but still below the record 11,780,000 bushels harvested in 1966–67. The yield average of 23.0 bushels per acre was well below the record of 30.6 established by the 1966–67 crop. An increased quantity of grain was handled and marketed in bulk.

In 1967–68 the drought-affected crop totalled only 4,834,000 bushels (comprising 3,474,207 bushels of two-row types, and 1,359,576 bushels of six-row types) from an area of 367,500 acres sown for grain; for an overall yield average of 13.2 bushels per acre. In that 1967–68 year, barley sowings for all purposes (grazing, hay, and grain) totalled 425,850 acres.

For the 1969–70 sowing season, a marked increase in acreage is expected to have been sown for both feed grain and malting purposes. Many wheat growers, threatened by over-production, and mindful of the unfavourable sales situation, have diverted part of their acreage to barley.

Barley Experiments

Variety Trials Statistics.—In 1968–69, replicated barley variety trials were arranged with twenty-five farmers (twenty-one in 1967–68), supervised by nineteen (sixteen) District agronomists, testing a total of thirteen (eleven) varieties. Also, trials were conducted at Wagga Agricultural College and the Trangie, Cowra, and Condobolin Research Stations.

Barley Variety Performances.—The dry early spring in most areas meant that the season mostly favoured early maturing varieties. Of the six-row or feed types, Beecher was the outstanding variety; followed by Abyssinian and then Ablyn. Among the malting (two-row) varieties, Proctor—the latest maturer—yielded poorly. Research and Noyep, respectively mid-season and very early maturing, were generally equal to Prior. Dampier and Bussell, two new introductions from Western Australia, did very well.

Fertilizer Trials Discontinued.—Some barley fertilizer trials were conducted, but these were discontinued during the year. Staff is not available for a programme that would have to be staffed full time, to cover the needs adequately.

Barley Variety Recommendations

Separate, detailed variety and sowing recommendations were made in early 1969 for the main barley-growing regions in New South Wales. The recent years' rapid increase in barley production, and the release of new varieties, have made desirable the annual up-dating of barley recommendations.

CEREAL RYE

Acreage and Production

Latest available production statistics are for the 1967–68 season, when 16,572 acres of rye were sown for all purposes—including 9,696 acres utilized for green forage or hay. In that year, 48,627 bushels of grain were harvested from 6,876 acres, for a yield average of 11.1 bushels per acre. Grain production in 1968–69 has been estimated as well above that of 1967–68.

Growers' intentions at the start of 1969–70 were to sow appreciably more than in 1967–68, despite possible over-supply of the local grain market if this were done.

Departmental Basic Stocks of Seed

The Department maintained basic seed stocks of Weethalle and Strain 8, and distributed seed of each to co-operating farmers for seed increase and general distribution to other growers.

WHEAT, OATS, AND BARLEY PURE SEED PRODUCTION

Supplies of pure seed of recommended and promising varieties of wheat, oats, and barley were increased at eight Research Stations, and distributed by means of Registered Seed Growers throughout New South Wales.

Foundation Seed sowings at Research Stations in 1968–69 totalled 135 acres of wheat (85 in 1967–68), 85 (35) acres of oats and 24 (21) acres of barley. Also, and associated with those sowings, the initial selection and preliminary seed-increase of wheat, oats, and barley were done at Temora Research Station.

A total of 328 Registered Seed Growers participated in the Registered Seed Scheme in 1968–69 (298 in 1967–68), and dispersed large quantities of pure seed to other farmers. In all: 167 Registered *Seed Wheat* Growers (153 in 1967–68), working under the supervision of 25 (26) district agronomists throughout the wheatbelt, using Foundation Seed supplied by this Department, undertook seed increase of 17 (15) varieties; 130 (116) Registered *Seed Oat* Growers, in 28 (25) district agronomists' areas carried out seed increase of 14 (14) oat varieties; and 31 (29) Registered *Seed Barley* Growers undertook pure seed production of 8 (7) barley varieties in 16 (15) district agronomists' areas.

The potential of systemic fungicidal seed-preparations for control of loose smut of wheat and barley was investigated after a recommendation arose from the Principal Agronomist (Cereals) visit overseas in 1966. Results were so promising that for the 1969 sowings the Department treated, with the systemic fungicide vitavax, large quantities of wheat and barley foundation seed supplied to Registered Seed growers. Also, all wheat and barley seed sown in 1969 at Departmental Research Stations for production of pure seed was similarly treated.

MAIZE

Acreage and Production Increase

Bigger Acreage.—Maize acreage increased by a further 13 per cent to 76,000 acres, after the 10 per cent increase in the preceding year. Further use of inland irrigation acreages accounted for almost half of the increase, and there were 18,500 acres of irrigated maize this year. Mainly, the increase in irrigated maize was of the special purpose type for waxy starch extraction.

Excellent Yields.—The estimated yield average of irrigated maize rose spectacularly to over 90 bushels per acre, reflecting better seasonal conditions and improved grower methods.

Dry conditions in late summer on the North Coast depressed yields slightly, but the increased area (58,000 acres) provided a production level equal to the previous year.

Overall, production rose by 38 per cent to an estimated 4½ million bushels, largely due to the increase from irrigated areas. Growers have become more conscious of the need for better plant nutrition, closer attention to plant populations, and maintenance of uniform moisture—with no stress point throughout the growth period—particularly at tasselling.

New Hybrids.—A new short-growing, very early maturing hybrid (XL45), introduced by a commercial firm, performed outstandingly under a wide range of conditions. This hybrid and other normal stature hybrids continued to produce creditably—with yields in some cases over 200 bushels per acre. A grower with 500 acres of another hybrid harvested an average of over 120 bushels per acre, despite harvest losses due to high grain-moisture.

Harvesting and Drying.—Rainfall from early autumn onwards interfered with maize harvesting, particularly in southern areas, where falling temperatures slowed field-drying. Artificial grain-drying was resorted to in most areas. Some attempts at too rapid drying led to damage which precluded the grain's processing for human food.

Boggy conditions prevented the use of heavy row-harvesting maize combines. Some crops stood well into winter before harvest was completed.

Contract Growing.—Increased awareness of the potential of maize and the need for reliable supplies resulted in the arrangement of contracts for maize production, mainly for food processing.

Increased Waxy Maize Acreage.—Demand in the food processing and adhesive industries in Australia and overseas resulted in 180 per cent increase of area sown to the waxy maize hybrid NEH 1215 Wx. Over 7,000 acres was sown, all under contract. Seed for this acreage was produced from an area of 40 acres.



In the Hybrid Maize Improvement Programme

The breeding and selection for agronomic characters in hybrid maize has provided among other things, this upright leaf habit—a marked contrast to the normal growth.

Nutritional Disorders of Maize

Zinc Deficiency.—Symptoms of zinc deficiency have been observed in maize in most inland parts of the State, usually where alkaline soil conditions and/or the high production level overtakes the soil's ability to supply this element.

Co-operative studies with the Chemistry Branch, of zinc deficiency in maize and other irrigated summer grain crops have been increased. And the probability of other minor-element deficiencies has been further investigated under both field and glasshouse conditions.

Molybdenum Deficiency.—On some soils heavy applications of molybdenum (up to 1 lb of molybdenum trioxide per acre) have been needed to ensure an adequate level of molybdenum in seed maize. A routine check has been maintained on all seed from suspect areas.

Hybrid Maize Improvement Programmes

The Commercial Programme.—Commercial organizations' production of hybrid maize seed has previously been confined to the earlier maturing types well suited to the tablelands and inland irrigation areas. But they are now interested in development of hybrids for coastal conditions.

Farmer organizations producing the hybrids developed by the Department for coastal conditions have made initial moves to produce and distribute these seeds as a State-wide co-operative.

Commercial enterprises imported a large number of inbreds for development of new hybrids, and these have been grown in approved quarantine areas for inspections by the Department.

The Departmental Programme.—Programmes to produce early and later maturing maize hybrids were continued at the Glen Innes and Grafton Agricultural Research Stations respectively.

At Glen Innes, seed stocks of 100 inbreds were renewed and twelve introductions from Kairi Agricultural Research Station, Queensland, were grown.

Indications are that two waxy maize inbreds developed will form a basis for waxy hybrids, non-receptive to pollen from ordinary maize—thus preventing the contamination which reduces the value of waxy maize for processing.

Development of inbreds for high lysine hybrids was carried a further generation of back crossing to the recurrent parents.

Gene-pool development was continued with random matings of material from the Australian Variety Collection, open pollinated variety selections, and single cross selections including some incorporating the South American inbred M11451. This inbred, despite some poor characteristics, has genes for high-yielding.

Seed of seventy-six open pollinated varieties was renewed by sib pollination.

Yield testing this season was done under conditions producing a yield average of over 100 bushels per acre; comparable with yields in the main areas of application of the hybrids.

Screening of inbreds for resistance to maize dwarf mosaic continued. One derivative of inbred C103 showed resistance. The mode of inheritance is being studied.

At the Grafton Research Station (where, for the previous four years, floods had reduced the programme's effectiveness) this season was affected by drought. It limited the production of most of the material.

By hand-crossing, 201 fixed inbred lines were maintained but uneven grainset, due to the dry season, reduced the yields. Seed of experimental top crosses, single crosses and double crosses were produced in nine isolations and two hand crossing blocks, but yields were generally low. Three further isolations could not be sown because of the dry weather.

Some late-maturing inbreds, including CA, CF1, HB and 13A, showed good combining and standing ability. Mid-season lines T204, L2, NN18 and introductions Tx403, Tx302 and Tx402 showed promise.

The male-sterility character has been applied to a number of inbreds. Among these are the parents of the mid-season hybrid GM211. Seed of this hybrid can thus now be produced by the male-sterility technique.

Fifty-seven back-cross progenies of twenty-seven Grafton inbred lines were developed. This was with a view to evolving modified dwarf variants of these lines which will produce late-maturing hybrids comparable in stature with the shorter-growing early-maturing hybrids. Second back-crosses of nine elite inbreds, to non-recurrent high lysine (opaque-2) gene parents, were made.

Eleven inbreds were introduced from Florida, Arkansas and Georgia, U.S.A., whilst elite Grafton lines were forwarded to Texas. Hybrid seed of GM211, GH128 and GH134 were sent to Hungary. Sixteen lines from the International Maize and Wheat Improvement Centre, Mexico, were grown with GH128 as pollen parent.

To maintain genetic stocks, a balanced mixture of seed from the Australian Variety Collection was sown to permit the development of an "Australian Variety Composite".

Under dry conditions the spread of the leaf blight fungus *Helminthosporium turcicum* was insufficient to permit selection of resistant plants. The only infection was on the inbred B15 reputed to contain a major gene for susceptibility.

Trials and Experiments

Hybrid Maize Trials.—Trials were conducted to determine the yielding ability of early, mid-season and late maturing maize hybrids in their appropriate areas.

Among the early maturing hybrids the semi-dwarf XL45 was outstanding in many trials, whilst new commercial hybrids DS809 and Pioneer Q301 showed great promise. Standard hybrids NEH1151, NEH1215 Wx, DS601 and DS606A continued their known high performance, whilst experimental hybrids NEH1317 and NEH1033 again produced good yields.

Yield trials of later maturing hybrids on the coast showed high levels of production from experimental hybrids GH390 and GH348, whilst the standards GH128 (late maturing) and GM211 (mid-season) continued reliably high.

GH128 and GM211 were included also in some inland irrigation trials and were remarkably productive—particularly GM211.

Maize Populations Trials.—At Leeton Agricultural Research Station an excellent trial confirmed 18,000 to 20,000 plants per acre as the optimum for standard hybrids, and 25,000 to 30,000 for the semi-dwarf XL45.

Small trials on the north coast indicated good yield responses with as many as 18,000 plants per acre. Response to nitrogen varied with soil type.

In inland irrigation areas maize crop competitions attracted numerous crops, particularly of the semi-dwarf hybrid XL45, with estimated yields in the vicinity of 200 bushels per acre.

Weed Control.—Weed control effected by atrazine at 2–3 lb of active ingredient per acre, has not been surpassed. But the long residual action of this chemical in some circumstances limits its use, where immediate second-cropping with a susceptible crop is practised.

Hybrid Maize Seed Certification

Hybrid maize seed certification details are as follow:

Hybrid	Growers	Acres	Production (50 lb sacks)	Yield av. (sacks per acre)
Early	10	98	5,652	57.7
Midseason	8	27	778	28.8
Late	31	501	13,530	27.0
1968–69 Totals	49	626	19,960	32
(1967–68 Totals	62	572	21,936	38)

The grading nomenclature introduced in 1967–68, with minor alterations of the lower grades, has succeeded in removing unnecessary resistance by buyers to seed other than top grade.

SWEET CORN

Acreage and Production

Sweet corn remained at the 3,000 acre level, with production areas at Tumut/Gundagai, Forbes, Bathurst, Cowra and Windsor.

Crops did not suffer the same hot windy conditions as in the previous year and were generally superior, with yields up to 7½ tons of ears per acre. In the main production centre, Tumut/Gundagai, yields ranged from 2.7 to 4.8 tons per acre.

Iochief was still the main variety grown commercially, but NK195 and NK199 are increasing.

A variety trial of seven hybrids was conducted at Hawkesbury Agricultural College but the three used commercially (Iochief, NK195 and NK199) were superior. Quality tests were included.

Sweet Corn Improvement Programme

Inbreds 1.453 and 1.5125, the parents of Iochief, were checked at Glen Innes Agricultural Research Station for any changes in individual characteristics—such as may have occurred under selection pressure during the generations of inbred maintenance. No significant change was detected.

The breeding programme has now produced a male-sterile form of 1.5125, and second generation progenies of the fertility-restorer recovery of 1.453 will be available for testing in 1969–70.

Yield and freezing-quality tests were done on five hybrids, and observations were made on further others. There is mounting interest in the marketing of snap-frozen sweet corn as husked ears (trimmed to a standard length and packed in clear polythene) as an alternative to ears sold in the husk.

POPCORN

Popcorn production is confined to contract growing of hybrids for commercial firms; with production areas in the Mudgee and Gunnedah districts. A booklet on popcorn was published by the Department this year.

Popcorn Improvement Programme

The project to produce the hybrid NEP37 by the male-sterile method was continued, and a male sterile line of SAA1–6 is now available.

Progeny of the present development stage of the restorer-line SA1490–3 have proved male-sterile. Therefore production of the restorer line must start again from residue seed.

GRAIN SORGHUM

Acreage and Production

The irrigated areas sown to grain sorghum increased dramatically (by 76 per cent), from 34,000 acres in 1967–68 to 60,000 acres in 1968–69. The dryland sowing was over 105,000 acres, mainly on the northwest slopes and plains, but poor seasonal conditions reduced the harvested area to about 48,000 acres. Lack of rain at the critical flowering periods in areas west and north of Narrabri was the main trouble for dryland crops. The effect was not so great to the east and south, resulting in a reasonable average of 21 bushels per harvested acre.

Production from irrigated areas was estimated at 4.6 million bushels and the dryland area at one million; totalling, by estimate, a record of 5.6 million bushels.

The yield average of irrigated crops showed an increase of 22 per cent, reflecting better farming methods as well as improved conditions. Crops were not so severely stressed by hot dry winds at flowering. Some irrigation crops yielded over four ton and there were many three ton crops, whilst the average was 2.07 ton per acre.

Japanese traders and their agents were again active in purchase of grain sorghum and arrangement of contracts for supply. However, when in previous years the combined production in New South Wales and Queensland has exceeded 14 million bushels there has been little for export. Reduction of the 1968–69 Queensland crop by drought limited the two States' production to about two-thirds of this figure. All of that could be absorbed by the domestic market. Prices on the local market opened at \$52 per ton (Sydney) as compared with the export price of \$39 at seaboard.

Early autumn rains in southern areas retarded harvesting although harvesters, not requiring row-crop attachments as for maize, were able to operate more readily on the wet ground. Grain drying was essential in most crops, to ensure a safe moisture level for storage.

Competition by commercial seed firms to supply hybrid grain sorghum seed was keen. The DeKalb Shand Seed Company, Northrup King, Pacific and Pioneer hybrids originating in U.S.A. and many U.S.A. Research Station hybrids, seed of which is produced by Queensland Certified Seed Growers, were available.

Waxy sorghum (Combine Waxy Kafir) was grown under contract to Wheat Industries Australia Ltd for processing purposes.

Grain Sorghum Trials

Rather than increase the already large number and range of grain sorghum hybrids available to the farmer, the Department continued to concentrate on the evaluation of hybrids nominated and supplied for sale by commercial seed firms. As with hybrid maize, the Department continued to publish the results of these trials on an annual basis; complementing a similar publication by the Queensland Department of Primary Industries.

Mid-season hybrids, including Tx626, Tx610, NK212 and E56A, and late maturing hybrids Tx671, Pacific 579, Pioneer 846, E57 and NK310 have dominated the trials on a yield basis—particularly under irrigation. However, shorter season hybrids have produced good yields and may suit some farm programmes—by reducing irrigation need or fitting into a closer rotation. Hybrids NK2207, Pacific 222 and on occasions the very early maturing Pacific 007 have produced very well.

Grain Sorghum Experiments

Seeding Rates and Plant Populations.—Trials at Leeton and Narrabri Agricultural Research Stations investigated plant population rates. Four hybrids were tested at populations which ranged from 50,000 to 120,000 per acre, although the intention was 60,000 to 150,000. Under good soil moisture and plant nutrient conditions there appeared to be no material benefit in having more than 80,000 plants per acre. However, field germination proves to be a problem even under irrigated conditions. It can be as low as 60 per cent. So, enough seed for 135,000 plants may be sown, yet only 80,000 might result. Fortunately it is unlikely that yield would be affected significantly should either population be achieved.

Fertilizer Trials.—Nitrogen studies failed to produce specific results. Initial nitrogen status of the soils used was too high.

Many areas have shown response to zinc applications particularly in the northwest. This is the subject of co-operative studies involving chemists and agronomists.

FORAGE SORGHUMS

Production Trend.—Hybrid forage sorghums and sudan grasses constitute the bulk of summer forage crops. Open pollinated and hybrid sweet sorghums are used, mainly for silage or for mature fodder for dairy stock on the coast.

Hybrids.—Numerous hybrids continued to be available commercially. These included Sudax, FS22A, Sordan, Trudan, Zulu and Forager which, by production trials in previous years, had been found comparable.

Trials.—Yield trials of available hybrids had been conducted at Research Stations and in districts until 1966–67. From these it became apparent that there was little to choose between the main hybrids for grazing, whilst the hybrids and open pollinateds were comparable for silage purposes.

Trials in 1967–68 continued to confirm these findings. So, further work will comprise only demonstrations in districts where thought needed—unless significant new material is provided by commercial seed firms.

MILLETS

Broom Millet Acreage and Production

Broom Millet production was estimated at 9.5 short tons, from a harvested area of 2,350 acres. Some 75 per cent of the acreage was in the Tumut-Gundagai district.

Production was enough for the needs of manufacturers. Quality was very high; the best for many years.

Best quality brush realised prices up to \$510 per short ton, whilst the ruling price for average quality was in the vicinity of \$450 per short ton. Interstate buyers competed strongly for good quality brush. A substantial area of the Tumut crop was grown under contract to processors in Victoria.

White Italian, selected by the Department, was grown almost exclusively—because of its high quality and suitability to local broom-making. Some small areas of inferior varieties were grown experimentally by several growers. Few harvested significant quantities.

Broom Millet Improvement

Seven selections of White Italian were observed for performance. Dwarf Tan was compared with the standard strain of White Italian and did not perform satisfactorily.

Observations were made on eight varieties introduced from U.S.A. None showed any degree of superiority over White Italian, except that some showed higher resistance to red stain.

Fodder and Grain Millets

The pearl millet Tamworth was grown for seed and green feed on a wide scale for the first time. With grazing potential slightly inferior to the hybrid forage sorghums, it is favoured by some growers because its prussic acid content is nil at all growth stages.

The Tamworth variety if grazed to reduce its height at harvest to a reasonable 6-8 ft may be used as a producer of grain millet, but drying of the "bullrush" head is difficult.

Of the grain millets, *Panicum* acreage increased ten-fold, to over 800 acres, with production over 8,500 bushels. French millet area increased to over 200 acres, with production over 2,500 bushels.

Japanese millet remains the most popular of the grazing millets. It provides much earlier feed than Siberian or pearl millets or the hybrid forage sorghums.

RICE

Production

Rice harvesting had not been completed at the time of preparation of this Report. Heavy autumn rains caused lodging in many crops and resulted in a prolonged harvesting period.

The Rice Marketing Board expected that total deliveries would be about 250,500 tons from 82,690 acres. If this were realized the yield average would be a record of over three tons per acre—produced by 1,800 growers (including share farmers) on 1,473 farms in the Murrumbidgee Irrigation Areas and districts, the Coleambally Irrigation Area and the Murray Valley Irrigation districts.

The increase in acreage from 75,688 in the 1967–68 season to about 82,690 in the 1968–69 season was largely due to expansion in the Coleambally Irrigation Area (a result of the opening up of new blocks) and the decision of the Minister for Conservation to grant water supply for rice on more farms in the Murray Valley districts.

The tabulation below sets out the position for the two years 1967–68 and 1968–69:

	Acreage		Acreage increase
	1967–68	1968–69	
Coleambally	13,699	15,715	2,016
M.I.A. and Districts ‡	42,486	42,694	208
Murray Valley	19,503	24,278	4,775
Total South Western Region ..	75,688	82,687	6,999

Rice Sowing Methods

Aerial Sowing.—This was again widely practised in the Murray Valley irrigation districts and accounted for 70 to 75 per cent of the area. Only a few crops were sown from the air in the Murrumbidgee and Coleambally Irrigation Areas. As in the past, in aerially sown crops some difficulties were created by growth of weeds (e.g., nutgrass *Cyperus rotundus* and pin rush). In crops badly infested by nutgrass, M.C.P.A. was used with good effect.

Combine Sowing.—Sowing into a prepared seedbed remains the most common method in the Murrumbidgee and Coleambally Areas. In 1968 there was a slight increase in sod-seeding. Sod-seeded crops generally produced well. This method offers the advantage of higher yields at lower costs than combine sowing and definitely has a future here.

Rice Varieties—The Changing Scene

There has been a very marked change in the variety situation in recent years. In the 1966 season Caloro comprised the bulk of rice sowings and the 115,000 tons it produced was twice the amount of Calrose. At the same time there were a small quantity of Bluebonnet (7,000 tons) and Kulu (65 tons). In the 1967 harvest, Calrose production equalled Caloro, Bluebonnet production had decreased, and Kulu had increased to 3,000 tons. The trend away from Caloro continued in 1968–69 as indicated by the following table:

	Percentage of Production	
	1967–68	1968–69 (Estimated)
<i>Coleambally and M.I.A.</i>		
Calrose	72.5	76
Kulu	9.5	17
Caloro	18.0	7
<i>Murray Valley</i>		
Calrose	65	77
E. Caloro	35	23
<i>Totals (South Western Region)</i>		
Calrose	71	77
Kulu	7	13
Caloro	22	10

Liaison with the Rice Industry

Needs are changing, with an apparent increasing demand for long and medium-long grained types. The industry and the Department, aware of the need to look closely at type of variety to be grown, discussed the problem in May, 1969, to determine policy for the future rice breeding programmes. The resulting recommendations were:

- that Kulu be improved to equal the grain quality of Bluebonnet, or be replaced by a variety with grain quality equal to Bluebonnet;
- that Calrose be maintained at present standard or improved;
- that Caloro also be maintained at present standard (though there was uncertainty as to the ultimate need for this variety);
- that the new medium-long and long grain variety crossbreds be tested for a further year before deciding on seed-increase;
- that a more vigorous rice improvement programme be conducted in relation to the Murray Valley;
- that better germination and seedling vigour, improved straw strength, earliness, and uniform ripening be incorporated in new rice varieties.

Fortunately, in the current rice improvement programme at Yanco Agricultural College and Research Station the Department is already well on the way to most of those objectives.

Rice Breeding and Improvement Programmes

In January, 1969, an appointment was made to the second rice breeding position at Yanco. Until then the breeding programme was being maintained by the rice agronomist because of the absence of the first rice breeder on post-graduate studies in U.S.A. Selection within the most advanced September/October sown and November sown material was handled by the rice agronomist, and the new rice breeder took over all earlier generation material. New introduced varieties were sown in short rows to maintain stocks of seed in the variety collection, and the general breeding programme was continued.

The primary aim of this programme is to produce long, medium and short grained varieties suited to growing in the Murrumbidgee, Coleambally and Murray irrigation districts. Emphasis has been placed on the production of medium-long and long grained varieties. There would seem to be decreasing need to continue improvement in short grained types.

From the viewpoint of maturity period the work is concentrated on producing varieties suited to a September/October sowing in the Murrumbidgee and Coleambally Irrigation Areas and, if possible, in the Murray Valley. A second important objective is production of varieties for sowing in mid-November that will mature not later than the existing late-September sown varieties.

Rice Agronomy Research

Variety testing, and research on seed rates, nitrogen and phosphorus applications, time of topdressing, spacing rates, types of applicators for anhydrous ammonia application, and the relative values of various nitrogen sources, continued.

Of particular interest has been the testing of nitrification inhibitors and slow release nitrogen fertilizers. Ammonium sulphate with nitrification inhibitors gave significantly higher yields than ammonium sulphate alone. Slow release fertilizers also gave significantly higher yields than the control plots.

Rice Soil Testing

At a meeting of the Rice Soil Testing Sub-Committee held in April, 1969, it was agreed to extend the rice soil testing scheme to all rice growers wishing to participate—including those in the southern Irrigation Areas and Districts.

A condition of the expansion of the scheme is that the report sheets forwarded to the growers by Australian Fertilizers Ltd (AFL) will not indicate the rate of fertilizer to be applied but will merely state soil nitrogen content in parts per million. Also printed on the report sheet will be a statement to the effect that the grower is advised to consult his District agronomist concerning nitrogen application rate.

To cope with the anticipated increased number of growers involved, it was agreed that farmers may take the samples themselves—using a special auger evolved by AFL. A leaflet explaining the use of the auger and sampling techniques, together with a result form and explanatory note sheet, were prepared by the Department and agreed to by AFL.

Miscellaneous Crops

COTTON

Production Trends

Record 1969 Crop.—The New South Wales cotton industry, although adverse harvesting conditions decreased yields, again produced a record crop. It was estimated at 130,000 bales (1 bale = 480 lb raw cotton) from 60,787 acres. This production was sufficient to meet Australian requirements. The estimated yield average of 2.14 bales/acre would be comparable with the average 2.16 bales of 1966 and 2.17 bales of 1968.

The Namoi Valley.—Namoi Valley continued to be the major production region. There, the estimated 52,000 acres was expected to produce 111,000 bales. Some growers used part of the 1969–70 water allocation to meet their 1968–69 needs. This could be an embarrassment to 1969–70 production.

Conditions were somewhat variable. Twenty per cent of the acreage was resown because of serious seedling losses, through disease. Mid-season conditions were satisfactory but adverse late season and harvest weather reduced the expected yields.

Macquarie Valley-Bourke Area.—This region showed the largest area percentage increase; from 5,416 acres in 1967–68 to 8,084 acres in 1968–69. Subject to a satisfactory harvesting the acreage was expected to produce 17,500 bales.

A feature in this region was 220 acres of narrow-row cotton (7 inch row-spacing).

The South Western Districts.—Cotton acreage here again fell. Some 700 acres, mainly narrow-row cotton but also some standard 40 inch rows, and a small area of 25 inch spaced rows, were grown.

The extremely wet autumn seriously disrupted harvesting and, besides the effect on quality and grades, it seemed possible that some acreage might be impossible to harvest because of the conditions.

The Cotton Bounty

The previous trend (decreasing bounty per lb of raw cotton) was accelerated by the decision of the Commonwealth Government in the second half of 1968 to apply the system to all cotton produced and not only to that used by local spinners.

Cotton Fibre Testing Laboratory

Construction of the laboratory approved in 1963 has yet to start, but plans have been drawn up for interim relief of the now critically inadequate existing facilities. The volume of cotton fibre testing and the staff number are limited by the available air-conditioned laboratory space. The work in hand has been possible only through co-operative actions of the University of New South Wales and Bradmill Industries in making air-conditioned space available for a period that is now approaching 5 years.

Samples from the plant breeding and general research programmes continue to accumulate. Priority ratings for testing are applied to all samples, but the shortage of fibre testing is resulting in incomplete data.

Cotton Breeding, Improvement and Quarantine

Appointment of a replacement cotton breeder late in the 1967–68 season enabled the breeding programme to be resumed in 1968–69—though on an incomplete basis. Progeny testing and *Verticillium* wilt-testing continued; also, additional testing of more advanced material. Crossing, and breeders' seed increase also were undertaken.

Quarantine activities comprised observations on fourteen Russian and three North American varieties.

Cotton Varieties

Deltapine Smoothleaf remains by far the most important variety in New South Wales. Popularity of Stoneville 7–02 has waned, mainly because of its more precise management needs, compared with Deltapine Smoothleaf.

Namoi Valley producers have tested Hopicala and are hopeful of it providing a substantial amount of longer stapled fibre—thus displacing further imports. Also, growers anticipate that Deltapine 5540 and Deltapine 45 may provide better *Verticillium* wilt tolerance.

Southwestern growers, lacking availability of a suitable alternative in quantity, have again relied on Empire 289.

Advanced variety testing was conducted at three sites in the Namoi Valley, one in the Macquarie Valley and three in southwestern areas. At the southwestern sites the varieties were examined under both narrow-row (7 inch) and wide row (38 to 40 inch) sowing.

National variety trials were also conducted, in the southwest and in Namoi region, as part of an Australia-wide series of cotton trials.

Cotton Production Research

Nitrogen.—Research into cotton petiole-nitrate as an indicator of plant nitrogen need is now well advanced. Good progress was made in research on a soil test for nitrate, natural soil nitrogen release, and plant uptake. Preliminary investigations include fallow release of soil nitrogen, application of anhydrous ammonia in irrigation water, loss of ammonia by volatilization, and nitrate toxicity.

Zinc.—Cotton response was again noted in the Namoi Valley, under conditions similar to the previous year's. No further investigation was possible, as the grower elected to apply the previously demonstrated corrective action to the area.

Gypsum.—Investigation into the use of gypsum continued, both for furrow irrigated and narrow-row flood irrigated cotton after rice. Results were not uniform but some yield improvements were attributable to gypsum application.

Cotton Diseases.—Investigations into crop establishment problems and *Verticillium* wilt were carried out from Tamworth Agricultural Research Station. The seedling disease caused by *Pythium* was prevalent in the spring of 1968. Considerable research was done on *Verticillium* incidence and strains, biology of the fungus, and genes for resistance.

TOBACCO

Production and Trends

The trend to increased tobacco acreage which showed up in 1966-67 accelerated during the 1968-69 season, when 2,180 acres were planted—as against 1,789 in 1967-68. All but 46 acres of this year's crop was grown in the north.

As recently as April, 1969, the yield average was thought likely to approximate 1,100 lb per acre. This would have resulted in total production of about 150,000 lb less than the quota of 2,563,000 lb of leaf. However, because of mild conditions in May, the acreage 5 per cent expected to be frost-damaged escaped injury. Yield average is now estimated to be in the vicinity of 1,150 lb per acre. Thus, N.S.W. producers may get close to the State quota.

Tobacco Marketing and Finance

The organized tobacco marketing system in the three eastern mainland States, implemented through the Australian Tobacco Board and respective State Boards, continued satisfactorily.

The three States' Tobacco Boards set up the Tobacco Industry Leaf Finance Agency this year. The Agency works in close consultation with the Australian Tobacco Board and the individual tobacco manufacturers to arrange finance to cover portions of the annual Australian tobacco crop. This is an important aid to the tobacco industry.

Tobacco Research Facilities

Construction of research facilities at Ashford was completed in May, 1969. A revised allocation of \$25,000 was approved late in 1968 for the construction of a main workshop, curing and bulking building, two tobacco barns and a lock-up machinery building.

Office alterations and glasshouse heating at Glen Innes are currently receiving attention by the architect and agricultural engineer.

Tobacco Extension Service

For extension reasons, all tobacco growers were visited. Extension advice and help were given this year in connection with soil samples, fertilizer application, calibration of equipment for herbicide application, penar application for sucker control, salvaging of hail-damaged crops, and general cultural operations.

At the 18th Meeting of the New South Wales Tobacco Advisory Committee the Department agreed to carry out during 1969-70 a programme of planned extension involving three visits to each tobacco farm, use of grower meetings, use of radio broadcasts, and bi-lingual publicity releases (in Italian and English language).

LINSEED

Production

In Australia the oil derived from linseed is used entirely for industrial purposes. Although a number of the edible oils may substitute for linseed oil in industry, linseed is not used as an edible oil seed.

Australia's production of linseed has varied greatly during the past five years; e.g. a record high of 46,600 tons in 1964-65 and a low of 6,064 tons in 1965-66. On the other hand, annual Australian needs have been relatively stable at around 25,000 tons in recent years. When Australian production has fallen short of needs, the gap has been filled by imports under Customs by-law.

At farmer level, linseed production is in direct competition with wheat. The current expansion (14,000 acres grown in 1968-69; 10,000 in 1967-68) reflects primarily the wheat farmer's need of an income source alternative to wheat.

Long-term prospects for expansion of linseed production appear to depend on increase of domestic consumption and of export opportunities at a price that would mean a gross margin per acre competitive with that of wheat.

Linseed Research and Variety Testing

This type of work was limited during 1968-69 to the build-up of seed of three varieties, introduced from U.S.A. and passed through quarantine last year. These varieties, developed in U.S.A. for irrigation conditions, are Denes, New River and Imperial.

SOYBEANS

Production Trends

Soybean acreages and production for New South Wales from 1964 to 1969 as shown in the following table, indicate the increasing interest in this crop.

Year ended 30th June	Acres sown N.S.W.	Grain production (bushels—60 lb)	Yield average (bushels per acre)
1964	100	600	6.0
1965	202	1,200	5.94
1966	NA	..	..
1967	191	820	4.3
1968*	191	918	4.8
1969**	1,370	33,600	24.5

* 1964 to 1968—Commonwealth Statistician's figures.

** 1969—Based on reports from District agronomists and other sources.

In Queensland some 4,500 acres were sown during the 1966-67 and 1967-68 seasons.

The 1,370 acres sown in New South Wales in the 1968-69 season were practically all grown under irrigation. Yield average for N.S.W. during the past season is estimated to have been 24 bushels per acre; but yields in experiments exceeded 60 bushels per acre, and there were commercial-area yields as high as 56 bushels per acre. It is considered that commercial areas with good management and using existing varieties should yield in the vicinity of 37 bushels (or 1 ton) per acre.

In Dubbo district, 750 acres of soybeans sown this season yielded at about 30 bushels per acre. Some growers reported a seed-cracking problem during sowing. Indications are that a sowing rate of 60 to 70 lb per acre is needed for optimum plant populations.

Soybean Research

Older Trials.—Trials have been conducted by this Department for more than 50 years, but only during the past four seasons have "experimental" yields reached a sufficiently high and consistent level for interest in commercial production.

Lack of success in the earlier work was due in part to varieties less promising than those now available, but mostly to not enough basic knowledge of the complex soybean plant nor control over certain critical needs. Important lessons from the early investigations have been need of highly adapted varieties, and of irrigation—to ensure precise control of moisture in a very specific and narrow sowing period, and during flowering and seed-setting.

Breeding and Introductions.—The soybean breeder, in this his first full season, was able to make over fifty crosses. These crosses and those made late in the preceding year were made without the benefit of full local behavioural data concerning the parents.

From this original crossing programme, progeny from the Bragg x Hampton cross has been advanced to the F_3 and Bragg x Amredo to the F_2 generation.

Two hundred and forty varieties were subject of a preliminary testing programme, to obtain certain detailed performance and character data. This information is now to be used in determining the source areas of further introductions likely to be useful in the future breeding programme. Already it has been possible to select the following varieties as suitable parents in the breeding programme: Dare, Lee, and Bragg, from U.S.A.; Bangkok, from Thailand; Kiio Akidaizu, from Japan; and an unnamed line from the Yangtze Valley of China.

Co-operation was extended to and by the University of Queensland, by way of testing selected "K" lines derived from the University's soybean breeding programme.

A further ninety-three soybean varieties were introduced into the programme. These came from U.S.A., Rhodesia, Japan, Malaysia, the University of Queensland, and University of Sydney.

Variety Trials.—Varieties were tested comparatively on two commercial farm sites, for reaction to distinctly different levels of fertility and crop management. Pure-seed increase of selected promising varieties has started.

Selected varieties have been distributed to ten district agronomists for testing. Variety testing was conducted, also, at three Research Stations.

Time of Sowing x Variety Interactions.—Results supported the selection of early to mid-December as the most suitable sowing time in northwestern New South Wales.

Population x Row Spacing.—A trial using the variety Lee, and a border-check irrigation system, showed that higher populations caused the lowest pods to be high on the plant—an advantage at harvest—but consistent yield improvement from any particular population was not obtained. The 14-inch row spacing produced higher yields than 7-, 21-, or 28-inch rows, but no uniform trend associated with row spacing was evident. The yield average from the 14-inch spacing was 68.6 bushels per acre.

Nutrition Experiment.—In this, at Narrabri Agricultural Research Station, there were responses to zinc but not to phosphorus.

Pest Problem at Leeton.—Pilot sowings at Leeton Agricultural Research Station suggested that a production problem at that centre was injury caused by a bug which normally is biologically controlled.

SUNFLOWERS

Production

Sunflower production increased in 1968–69. The 8,800 acres was a record. There were 6,000 acres in 1967–68. Most sowings were in non-irrigated areas. In fact, there were 4,200 acres in the Coonabarabran district. State yield average was estimated at 540 lb per acre; but irrigated crops yielded from $\frac{1}{2}$ to $\frac{3}{4}$ ton per acre.

Introduced, high-oil varieties appear to be adapted to New South Wales conditions, and indications are that the crop presents few production problems.

Sunflower Research

Sunflower research has been limited to variety testing of the high-oil types, population studies, and preliminary fertilizer trials. There were yields of up to 2,265 lb per acre in Leeton Agricultural Research Station trials, and population studies indicated that at least 40,000 plants per acre should be sown with most varieties—but some appear to give maximum yields at lower populations.

Seed Increase

Sunflower cross pollinates. Therefore, adequate isolation from other varieties at flowering time is needed for production of pure seed. Seed was increased at a number of Research Stations and on selected private properties, to provide enough for further investigations and "experimental" plantings.

SAFFLOWER

Production

Safflower production in New South Wales over the recent six years is shown in the following table, wherein the Commonwealth Statistician's figures are used except for 1969. For 1969 the figures are Department of Agriculture estimates.

Year ended 30th June	Acres sown	Production (bushels—40 lb)	Yield average (bushels/acre)
1964	113	1,545	13.7
1965	2,253	33,373	14.8
1966	2,539	14,081	5.5
1967	5,092	71,823	14.2
1968	8,550	59,310	6.9
1969*	2,500	22,400	9.0

* Department of Agriculture estimates.

It will be noted that there were marked increases in safflower production from 113 acres in 1963–64 to 8,500 acres in 1967–68, then in the 1968–69 season the sharp fall to an estimated 2,500 acres. Because of good seasonal conditions the estimated yield average for 1968–69 should approximate 9 bushels per acre, as against 6.9 in 1967–68, but still not comparable with the 14.2 in 1967–68.

Safflower Irrigation and Root Rot

Reasonable yields have been had from time to time under irrigation, but *Phytophthora* root rot incidence has discouraged any large-scale irrigated safflower production. The plant is very susceptible to this disease after irrigation, when high temperatures are experienced. Until this problem is solved, either by new irrigation techniques or development or introduction of resistant varieties, there seems very little future for safflower in New South Wales.

Safflower Research

This has been limited to irrigated trials to examine time of sowing, method of irrigation, time of final irrigation, variety performance, and seeding rate.

Seed increase has been done only to provide pure seed for further research with new, promising varieties.

RAPE SEED

Annual need of rape seed oil in Australia has been 4,000–5,000 tons for the past three or four years. The need has been wholly met by importation until, in 1968–69, some 480 tons of seed, with an oil equivalent of 182 tons, was produced in Victoria.

Investigations during the year were limited to variety testing. Harvesting difficulties from shattering raise doubts of the future of the crop in New South Wales.

CASTOR BEAN

Variety testing and seed increase were done during the year.

Leeton Agricultural Research Station repeated the variety trial (with sixteen varieties) which failed in the abnormal 1967–68 conditions. Harvesting had not been completed at time of preparation of this Report.

SESAME

Seed increase of introduced varieties has been done at Research Stations for future variety testing.

Vegetable Work

INDUSTRY PRODUCTION TRENDS

Over Supply and Under Supply

With normal seasonal conditions, and many landholders looking to fresh-market vegetables to augment their incomes, there has been heavy production—with consequent over-supply and low prices. Growers in favoured localities able to concentrate on out-of-season produce were among the few who operated profitably.

Although there has been over-supply of most seasonal vegetables in the fresh market, the inland districts' production for processing suffered severely because of showery weather from late January to the end of May, 1969. Tomatoes were among the most seriously affected, the yields generally being less than a third of normal. Areas of French and field beans grown under contract to processing firms have also been damaged by the wet weather, and lettuce seed crops suffered severely.

Large Scale Mechanization Production

The trend to large-scale mechanised production was seriously set back by the year's adverse inland weather. Growers were at heavy expense in establishing and bringing to harvesting stage their extensive areas of tomatoes and beans for processing and lettuce for seed, then the onset of wet weather reduced the yields drastically. Only a fraction of costs was recovered. They had difficulty also in securing harvest labour, even relative to the reduced need where harvesting was mechanized.

More extensive production and increasing adoption of machinery for all cultural operations and also for washing and packaging have been features of the potato industry. Low prices have demanded use of machinery, to minimize production costs. Processor firms have shown interest in getting their new material from large-scale N.S.W. potato growers rather than from Victoria. Their interest was partly because of the lifting of the Road Transport Co-ordination Tax within 200 miles of Sydney and Newcastle, and partly because the quality of locally grown potatoes has proved acceptable.

POTATOES

Potato research was continued at the Glen Innes and Orange Agricultural Research Stations. The Glen Innes work is concentrated in particular on producing new varieties by breeding—an emphasis towards high quality. The work at Orange is designed to investigate the numerous factors affecting tuber quality and suitability for processing.

Potato Breeding

The Crossing Programme.—The breeding work at Glen Innes was hampered to some extent by drought early in the season and heavy rain during harvest, but the crossing programme continued to expand.

Some 1,160 separate crosses were made, resulting in the setting of 1,200 berries; about 450 more than in the previous season. Again a wide range of parents was used, with still more emphasis on use of locally developed seedlings as both male and female parents. In all, fifty-five female and forty-three male parents were used. These included three new varieties from Russia, and three new U.S.A. varieties—Platte, Sable and Hi-Plains. Also included were selections from the wild species *Solanum stoloniferum*—obtained originally from Cambridge with a view to producing varieties resistant to virus Y.

First-Year Seedlings.—About 23,000 first year seedlings were grown to maturity in the glasshouse. Promising lines came from crosses involving the varieties Adina, Navajo, Katahdin and the locally developed seedling S2898. The seedling S2898, a selection from the cross Kennebec x Katahdin, is proving a very useful parent.

Second-Year Seedlings.—There was again a big increase in total of second year seedlings planted in the field. Some 18,000 single plants were grown and, though selections have not yet been completed, there appear to be some outstanding lines from the U.S.A. variety Superior and the Canadian seedling F4724.

Third-Year Seedlings.—Third year seedling lines grown at the substation totalled 576. Only limited selection has taken place so far, but selections from crosses involving F4724 and the Estonian variety Olev appear to be the most promising lines. Other attractive seedlings were selected from crosses that have Adina as male parent, and also from the cross Navajo x late Katahdin.

Fourth-Year Seedlings.—Lines totalling 108 were grown on a farmer's property. Of these, one selection from the cross Fundy x S2882, two selections from the cross S2897 x (Kurrel x F2865) and one from the cross Pungo x S2885 were the most outstanding.

In the preliminary yield trial, forty-eight lines were tested in replicated plots. Early observations suggested that a selection from the cross Navajo x Late Katahdin and one from the cross S2897 x S2898 were particularly promising.

Advanced Yield Trials.—Yield trials of the most advanced seedlings were again grown at Guyra on the northern tablelands, and at the Orange Agricultural Research Station. Of the seventeen advanced lines in the trial at Guyra the seedlings S2962 (S2855 x S2782), S2963 (Walanga x (Sebago x 11-79)) and S2898 (Kennebec x Katahdin) showed particular promise in yield and in specific gravity (a quality indicator).

At Orange, the seedling 2897 (a selection from self-pollinated Redskin) continued to show great promise in yield and appearance. Other seedlings to perform well were S2939, S2898, S2941 and S2957.

Potato Activities at Orange Agricultural Research Station

Strain Trials.—The replicated trial comparing the Department's strains of Sebago, Katahdin and Kennebec with recently introduced American strains showed the new Katahdin and Kennebec strains to be superior in number of tubers set and in total yield, but there was no significant difference between the two Sebago strains.

Irrigation, Specific Gravity and Crisping.—Results from the irrigated trial on a grower's property are still being collected, particularly those concerning specific gravity and crisping quality at various stages of maturity. Progress indications are that the standard crisping-variety Kennebec is still one of the best for this purpose but a few locally developed seedlings (e.g. S2939) at least equal Kennebec in specific gravity and crisping quality. Also showing up well in the specific gravity recordings were two red-skinned selections from the cross (Sebago x 11-79) x Redskin, and the seedling S2949.

Herbicide Trials.—These were continued in dryland and in irrigated conditions. Preliminary observations suggest that at least two or three of the commercial herbicides will very effectively control weed growth in potatoes.

Other Trials.—An irrigated variety trial, and a trial to determine best spacing and fertilizer rates for Kennebec are some other activities now established at Orange. In the irrigated trial, Kurrel yielded 27 tons to the acre; compared with Kennebec 22, and Sebago 19 tons. In the spacing x fertilizer trial the highest percentage of table grade tubers came from the five inch spacing, and another observation was that as nitrogen fertilizer rate increased the tuber specific gravity decreased.

District Potato Yield Trials

Variety and advanced seedling yield trials were established in several potato growing areas.

In the comparatively new Coleambally Irrigation Area the varieties Murru (15 ton/acre), Kurrel (13 ton/acre) and Sebago (12½ ton/acre) did best.

In coastal highland areas (e.g. Dorriggo (north coastal) and Robertson (south coastal)) the red-skinned seedling S2897 again gave excellent results and the local varieties Jala and Kurrel also yielded well. In most of the coastal trials the standard variety Sebago was out-yielded by Bungama, Jala and Exton.

In the limited number of tableland trials, S2897 and the later maturing varieties yielded highest. In all cases the seedlings were compared with the standard variety Sebago.

Potato Seed Production

The Potato Seed Certification Scheme.—One thousand three hundred and thirty-six acres were submitted, by 129 growers, and 1,275 acres were passed for certification (rejection rate—4.5 per cent). In the previous season (1967-68), 917 acres—from 101 growers—were certified.

The Approved-Seed Scheme.—This continued to expand. Forty-four growers submitted 651 acres in all, and 556 acres were passed (rejection rate—13 per cent). In the previous year, thirty-six growers submitted 552 acres in all.

Elite Seed.—A limited quantity of elite seed of Sebago was made available to selected growers for production of foundation seed. Unfortunately, an unusually late infection of virus leaf roll (in the previous season) resulted in a small percentage of leaf roll infected plants amongst the foundation seed crops. In consequence the original scheme as outlined in last year's Report is being re-examined for possible modification.

Pleasing in this initial release of elite Sebago was seed growers' enthusiasm for the agronomic type of the particular line released. Five years of rigorous selection procedures have produced a line significantly better than existing growers' strains. Further selection and subsequent tuber indexing are proceeding. About 25 tons of seed Sebago is available at the Orange Research Station for release to selected seed growers in the coming season.

TOMATOES

Breeding Programme

At Yanco Agricultural College and Research Station.—Transfer of the former research officer from Yanco to Hawkesbury Agricultural College, followed soon after by the National Service call-up of the new Yanco research agronomist, seriously affected continuity of the tomato improvement programme.

At Hawkesbury Agricultural College.—A wide range of varieties and of crossbreds were grown for observation and to acquaint the new breeder with the indeterminate varieties used by fresh-market growers. Best performers were the old established variety Grosse Lisse; V36, a semi-dwarf variety from the University of California; College Challenger, bred by the Department; and *Verticillium* wilt-resistant strains of Stokesdale and Valiant introduced from Canada. Of interest, Florolou—which has become popular commercially—did not equal the longer-known varieties.

Campbell's 146 x Oahu, Oahu x Grosse Lisse and Anahu D x Grosse Lisse were outstanding amongst the new hybrids under test.

Tomato Variety Trials

At Hawkesbury Agricultural College.—Unreplicated trials of staked and canning varieties were grown for visual assessments by the research officer and by growers, processors, and seeds-

men. Of the staked varieties, the consensus favoured Grosse Lisse and the hybrids College Cropwell, College Conquest, and Grosse Lisse x Rouge de Marmande. Of the canning types, the most favoured were YRF No. 2 (a fixed line from Roma x 255), Roma, VF145-22-8 x YTMF8 in the F_8 generation, and Roma x 255 in the F_8 generation.

At Yanco Agricultural College and Research Station.—Field testing of canning varieties was arranged, on two growers' properties; one at Griffith and one at Leeton. The varieties showing most promise as direct-seeded crops for possible mechanical harvesting were a selection from Long John and from Chico, both introduced from U.S.A. Others showing promise include YR No 3 (Roma x 255), Chico Grande, YRFM (Roma x 255), Campbell's No 17 and VFN48A from the University of California.

Other Tomato Investigations

Plastic Covers.—Use of black plastic "mulch" on the ground and clear plastic plant covers to enhance fruit set during cold weather, was on trial at Hawkesbury Agricultural College. Thermographic recording showed that the plastic covers in particular caused an increase averaging 8° F in the mean monthly maximum temperature.

The mean yield for plots using clear plastic alone was almost double that of plants receiving no treatment. Combined use of a black plastic ground mulch brought a further small increase.

Extension of the trial to the far north coast has been arranged. There the system should permit smooth-fruited varieties to set fruit satisfactorily during the cooler months.

Hormone Damage in Field Crops.—High incidence of hormone-like damage in crops which had received heavy applications of poultry manure was noted, especially in the Gosford district. A survey by the district agronomist in co-operation with the Division of Science Services revealed that the trouble was mainly associated with the use of poultry manure from broiler houses.

An inter-Divisional committee has been set up to study the problem. It has significance for poultry raisers as well as vegetable growers.



Cauliflower Clubroot Prevention; Bathurst District

The Biology Branch and District Agronomist in a co-operative project with the Vegetable Growers Association have shown that the soil-borne clubroot disease may be prevented in soils where the pathogen is prevalent, and cauliflower yield greatly increased, by soil-treatment with a newly available chemical.

BEANS

Bean Breeding

As with tomato breeding, the continuity of bean breeding has suffered by staff changes. Limited bean breeding was done this year. The improvement programme was confined mainly to the growing, for observation and assessment, of a broad base of varieties and material developed by the former breeder at Hawkesbury Agricultural College.

Bean Trials

The "Summer Death" Problem.—Most of the bean trials have been designed to elucidate the "summer death" problem. This disease was identified as caused by a virus and described by an officer of the Division of Science Services early in the year. The identification has pointed the need to screen varieties for resistance. The following paragraphs deal with the screening trials:

At Yanco.—A very wide selection of varieties was grown, and incidence of "summer death" disease was such that excellent assessment of reactions to it was possible. At the College and Research Station field day, seedsmen and processors were able to select varieties which were not only resistant to the disease but good in agronomic and processing qualities.

At Hawkesbury.—A duplicate of the Yanco screening trial was conducted and a number of varieties which had shown resistance in the Yanco trial were selected at Hawkesbury for quality testing by a processing firm. The assessment of quality has been made available to seedsmen and processors so that steps can be taken to arrange seed production of resistant lines. Varieties and crossbreds developed in Idaho and Washington State, U.S.A., for resistance to a disease like "summer death" were among the high-quality resistant lines.

At Orange Agricultural Research Station.—Several commercial varieties of French beans were grown here in a replicated trial, in association with the Biology Branch, to determine reactions to subterranean clover stunt virus. A general infection occurred, and enabled classification of the varieties for their reaction. As "summer death" was also widespread, the combined reaction was recorded.

Bean Seed Certification Scheme

Application for certification involved 58 acres, as against only 37 acres in 1967–68. Production is likely to be 450 bushels, compared with last year's 350 bushels. Production in the traditional, south coast districts is almost static, but this season an inland 20 acres crop was submitted.

ROCKMELONS

Improvement Programme

Breeding.—The improvement programme comprised the maintaining of stocks of advanced crossbred material, and continuing selection for resistance to *Fusarium* wilt and powdery mildew.

The two varieties named last year, Yanco Treat and Yanco Delight, were grown on a small scale on properties in the MIA and the Wentworth district and gave promising results.

A third promising line was further selected at Yanco and Hawkesbury Colleges.

ASPARAGUS

The trials conducted in association with Mountain Maid Food Co-operative were continued at Gundagai. Further useful results were obtained.

Herbicide Trial.—A new herbicide (hyvar X) gave such good results in the trials that it has been adopted in commercial treatment—with outstanding success. Additional trials are proceeding, to determine whether this herbicide's use may be extended to seedling as well as established asparagus.

Rotation Trial.—Results from the rotational trial over six years indicate that the long period earlier considered essential between asparagus crops may not be necessary. In association with this trial it has been found that the *Fusarium*-resistant asparagus strains from the University of California should permit an asparagus crop to follow asparagus as soon as the ground can be adequately prepared.

LETTUCE

Export Seed Industry.—Production of lettuce seed for export had increased rapidly in recent years but this time suffered a severe setback because of the phenomenally wet season in the MIA. Yield was only a fraction of the normal expectation. Disease contributed to the reduction, in the conditions.

PICKLING CUCUMBERS

Five varieties of cucumbers used for pickling or for processing as gherkins were in the observational trial at Narrabri Agricultural Research Station. Good commercial yields were indicated and, since the trial was established quite late in the season, suggested that two crops of gherkins for one year on the same land would be feasible in the northwest.

Pastures Work

RESEARCH

Staff Resources

During the year thirty-nine agronomists were engaged in pastures research. Three are in full-time study for the Doctorate degree at the University of New England; six on secondment to the CSIRO (two at Armidale and four at Canberra) for training in certain specialized fields; seven in districts, for adaptive pasture research; and twenty-one at Agricultural Research Stations. The Hawkesbury Agricultural College plant nutrition agronomist was transferred this year to Rydalmere, together with a second research agronomist—appointed to Rydalmere after a training period in plant nutrition research with the CSIRO. These two are now part of a co-operative team (of chemists and agronomists) in plant nutrition research.

Decentralized Leadership: Pastures Research Groups

Partial decentralization of pastures research administration has been effected, for more direct contacts and interchange of ideas between pasture research agronomists, and to reduce the administrative load in the head office Pastures Section. Six regional groups of the country officers, each with an appointed leader, have been established. The "bases" are Wagga, Condobolin, Tamworth, Wollongbar, Leeton and Rydalmere. Each group will meet at appropriate frequencies to discuss technical problems, and to undertake the basic planning and modification of projects and publications.

The 11 agronomists located at a CSIRO laboratory or University have not been included in a regional grouping. They already partake, through their association with well-established research groups, the benefits expected to accrue within the regional groupings.

TEMPERATE PASTURE SPECIES AND CULTIVARS

Legumes

Lucerne.—Lucerne value, for productivity and drought resistance, was highlighted in reports from districts in the south coast, tablelands and lower-rainfall inland areas. Promising results have been as far west as Cobarr. Large areas of cereals were undersown with lucerne in 1969.

Lucerne cultivars have been compared at several centres. Hunter River and Hairy Peruvian were superior to African and Cancreep after twenty-eight harvests at Narrabri, and Cancreep near Nowra gave a disappointing first year performance compared with Hunter River.

At Trangie, despite losses of plants from the stand, lucerne was of much higher carrying capacity than native pastures; three breeding ewes and 2.7 lambs per acre, or five wethers per acre, could be carried on rotationally grazed lucerne whilst native pasture could support only one dry sheep per acre. Sitona weevil is considerably damaging tableland lucerne.

Subterranean Clover.—Wooenellup (Marrar) gained increasing landholder acceptance at the expense of the traditional Mt Barker in tableland areas. Geraldton is now recommended for western areas of the Cootamundra district, and Clare is showing promise on the north coast. Yarloop did well on heavy soils in The Bland area.

A relatively new cultivar, Seaton Park, was superior to the traditional Dwalganup for better soils in the Temora district and is promising also at Leeton; Geraldton was found preferable on poorer skeletal soils in the Temora district. Twenty-six cultivars are being tested near Grafton in a search for a subterranean clover suited to the area.

White Clover.—An introduced white clover from "Israel" continued to give good production and persistency at Grafton, whilst a naturalized white clover ecotype also continued its good performance in the Clarence River district. Ladino is still the most common white clover on much of the north coast, but stands are short-lived. Factors concerned with this need elucidation.

Medics.—Lower seed prices promoted increased sowings of Jemalong barrel medic. It shows considerable potential for drier wheat belt areas—such as West Wyalong and Condo-bolin. At Condo-bolin Agricultural Research Station last season 30,000 lb of Jemalong seed were harvested.

Jemalong medic at Condo-bolin carried 1.25 dry sheep equivalents (d.s.e.) per acre, returning a gross margin of \$3.00 to \$4.00 per acre, compared with 0.5 d.s.e. and \$1.60 gross margin per acre on native pasture. The value of Jemalong medic pastures is due to good nutritional supply in late spring—early summer, avoidance of the grass seed problem of native pastures, ease of management, and high financial returns.

Other Legumes.—Crimson Clover has considerable potential as a pioneering legume on skeletal soils in the Yass Valley. Red clover has been shown to have a place in cool wet areas of the southern tablelands. Kenya white clover (*Trifolium semipilosum*) again gave good winter production at Grafton.

Grasses

Phalaris.—Phalaris acceptance increased at Inverell, Wagga and Bathurst and Bega. The hybrid 1146 was the outstanding cultivar in trials at Berry. Sirocco was best at Temora; but the value of a perennial grass in wheat belt areas such as Temora remains to be established.

Sirocco and hybrid 1146 were the best cultivars at Cowra, but total yield from plots containing them was seldom more than from plots not containing phalaris. This supports previously expressed doubt of the value of perennial grass species in certain wheat belt situations.

Ryegrasses.—Kangaroo Valley ryegrass has been outstanding at widespread centres; e.g. Kyogle, Lismore, Murwillumbah, Parkes and Bega. Perennial ryegrasses generally failed in the Cootamundra district.

Medea was the most persistent of ryegrasses tested at Temora, but produced less herbage than Merredin Early and some of the Kangaroo Valley ecotypes.

An interesting trend is the north coast use of annual ryegrasses, e.g. Wimmera at high sowing rates; as an alternative to oats for winter grazing.

Cocksfoot.—Interest in cocksfoot has waned, possibly due to reported non-persistence in drought. But Currie cocksfoot has persisted well on difficult skeletal soils in the Yass Valley and appears the most suitable perennial grass for these soils. However, persistence and production under grazing need further investigation.

Demeter Fescue.—This is losing popularity—due to the high seed costs, questionable palatability and doubtful persistence. Further trials and demonstrations are comparing it with phalaris cultivars, cocksfoot and ryegrasses.

SUBTROPICAL PASTURE SPECIES AND CULTIVARS

Subtropical Legumes

North coast interest in subtropical species continued. Establishment remains a problem. The most popular legumes are Clarence glycine, Siratro, lotononis and "Greenleaf" and "Silverleaf" desmodiums.

Aeschynomene falcata (C.P.I. 11500) continued to do well at Grafton and is being further tested there. Three promising native *Glycine* species (*G. tomentella* P. 8175, *Glycine* spp. "Yoongundie" P. 7874, and *G. clandestina* P. 7873) also continue under test at Grafton.

On ridge country near Grafton, lotononis has survived where other introductions have practically disappeared. Townsville lucerne in that environment gave poor regeneration, due to poor seed production after dry conditions. Establishment difficulties with lotononis make it less suitable than white clover

for widespread recommendation. Silverleaf and Greenleaf desmodium again made better growth at Taree under cold conditions than glycine or Siratro.

Subtropical Grasses

The most popular is *Setaria sphacelata*; 3,000 acres of it were sown in the Murwillumbah district alone this year. *Setaria* compared very well with kikuyu at Taree, and has been successful on reclaimed swamp areas along the Shoalhaven River, where two newer lines (C.P.I. 19915 and C.P.I. 32930) respectively outyielded by 280 per cent and 200 per cent the commonly grown cultivar Kazungula.

Kikuyu has succeeded at a number of coastal centres—from Kyogle to Bega; but this year the widespread incidence of "Kikuyu Yellows" disease has caused concern. A new variety (P. 713) has been good at Grafton Agricultural Research Station and is being considered for registration and release by the Herbage Plant Liaison Committee of New South Wales.

An innovation on the south coast at Berry has been the carrying of sheep on kikuyu pastures. Rotationally grazed, the pastures supported ten wethers per acre through the severe drought. Set-stocked kikuyu at the same rate did not maintain stock in sufficient condition for the treatment to continue.

PASTURE PLANT NUTRITION

Phosphorus

Phosphorus received most attention in studies of pasture nutrition. In particular, there has been increasing attention to evaluation of phosphorus responses in terms of animal production.

At Wagga a stocking rate x superphosphate trial has shown no animal production response to superphosphate rates applied during the pasture phase. (A trial at Temora is producing similar results.) However, it has been recognized that animal production responses to rates of superphosphate dressings on wheat-belt ley-pastures require careful interpretation in view of "carry-over" of phosphate effects from the wheat phase—and changes induced in grass/clover balance in the pasture.

At Condo-bolin, trials have been started to investigate the economics of various superphosphate maintenance rates for topdressing lucerne-based pastures in lower rainfall areas of the Central Western wheat belt. In this zone responses are very dependent on rainfall incidence.

At Shannon Vale, near Glen Innes, grazing trials with mature wethers for wool production have shown that $\frac{1}{2}$ cwt superphosphate/acre is apparently enough to maintain improved pastures on the granite soils in the area, following a total superphosphate history of 22 cwt per acre.

In the Yass Valley, placement of superphosphate at depths where soil moisture is available to plant roots is being tested on difficult skeletal soils. Besides high phosphorus-fixing properties, those soils suffer from poor moisture relationships in the surface layers.

At Leeton, there have been responses by wheat to residual phosphorus from various rates of superphosphate applied to irrigated pastures. Wheat yields were highly correlated with available soil phosphorus. Also near Leeton, naturally occurring *Medicago minima* on a mallee soil responded progressively up to 6 cwt superphosphate/acre.

Nitrogen

Oats + nitrogen and kikuyu + nitrogen have been widely used in the past two years to produce "out of season" dairy feed in coastal districts. Ryegrass + nitrogen has also been used, because of ryegrass seed at favourable prices.

However, in spite of quickening commercial interest, consequent increasing nitrogen-production potential and cheapening nitrogen, coastal farmers this year have used less nitrogen on kikuyu and other winter forages. The disappointing responses in dry conditions were largely responsible.

Wollongbar research is now seeking to relate moisture conditions to nitrogen response, to enable more economic nitrogen-use recommendations to farmers in light of soil moisture conditions.

In seed production trials of Kangaroo Valley perennial ryegrass at Berry last season, seed yields increased 200 lb/acre as a result of increasing the nitrogen application from 40 lb N to 80 lb N/acre.

Soil Acidity and Lime, and Interactions with other Elements

On soils from the Yass Valley, pot and field experiments showed responses to lime but there were some unusual lime-molybdenum interactions. Lime in some cases induced boron deficiency. Lucerne and phalaris grew normally when the pH of Yass Valley soils was raised above pH5 by liming (probably due to mitigation of aluminium toxicity), and also by improvement of nodulation and nitrogen fixation in the case of lucerne. However, raising the pH above 6 induced deficiencies of phosphorus and of boron.

On granitic soils near Temora, lime application to subterranean clover increased burr yield by 153 per cent.

Sulphur

Sulphur is now widely recognized as a deficient nutrient in many New South Wales soils. This year sulphur deficiency has been identified on several north coast soils; also in the Tamworth district—where its application as sulphur-fortified superphosphate has been recommended to meet sulphur-phosphorus needs on clover and lucerne-based pastures.

At Leeton a trial on irrigated lucerne showed response to up to two ton gypsum/acre. The nature of this response is being investigated.

Potassium

An extensive survey of potassium status of southern tablelands soils is being made. Potassium needs have also received attention at Wollongbar. There, responses to potassium were recorded on kikuyu after a year of intensive mowing and removal of herbage. "Ironbark" country near Temora has also shown potassium deficiency.

Minor Elements

Responses to molybdenum and copper have been recorded on soils from "ironbark" areas in the Temora district.

Legume Nitrogen

In the Yass Valley a nodulation problem appears to contribute to the difficulty in developing pastures on skeletal soils. An attempt was made there to create a better environment for applied rhizobia, by drilling soil from a long-established clover paddock into a skeletal site. There was no conclusive result.

PASTURE ESTABLISHMENT

Aerial Sowing

Research at Canberra has clarified factors affecting the establishment of aerially-sown seeds on unprepared soils. It was found that: phalaris establishment was increased by selecting varieties with desirable seedling growth characteristics; subterranean clover establishment was inferior to that of lucerne; the beneficial effect of shelter and shading was the result of improved moisture relationships around the seed; seed coatings promoted better moisture uptake; and legumes had more difficulty than grasses in achieving root entry to the soil.

An innovation, in Murwillumbah district, was aerial sowing of 500 acres of subtropical pastures. Sowing cost was about \$1 an acre. Results have been satisfactory.

Use of Companion Crops

Heavier sowing rates of subterranean clover under companion crops were found to improve second-year carrying capacity at Temora. Companion crops are being examined in the hope of improving establishment of subtropical species at Taree, and of obtaining better success with temperate species on difficult soils in the Yass Valley.

Sowing Method

Siratro and lotononis established well when sown by roto-seeder into natural pasture near Grafton.

Lucerne establishment was improved at Trangie by band-sowing, and sowing into furrows 3 inches deep.

PASTURE SEED PHYSIOLOGY RESEARCH

Using CSIRO facilities at Canberra, it was shown, in germinating subterranean clover seed, that water entry occurred mainly through the strophiole, but that significant entry was also through cracks in the testa.

Wollongbar investigations showed that short exposures of glycine seed to high temperatures during the imbibitional phase adversely affected germination.

PASTURE MANAGEMENT RESEARCH

At Leeton, research on irrigated pastures has indicated that four lambing ewes/acre can be safely carried, provided the pasture is spelled for three weeks after the February watering. Supplementation, by hand feeding or by use of sod-sown oats, affected animal production only slightly.

Use of hybrid forage sorghum as an alternative to perennial summer pastures for carryover lambs does not appear to be economic.

Near Grafton, dry conditions restricted butterfat production in two whole-farm studies concerning the effect of improved pastures on productivity. However, production was still significantly higher than before pasture improvement was introduced on the two farms.

At Glen Innes, trials with cattle showed that improved pastures maintained the fertility and production of breeding cows, but could not maintain adequate weaner growth without a high-quality supplement such as oats plus nitrogen.

At Shannon Vale Nutrition Station, evidence in sheep trials during the past year suggests that stocking rates of 4 to 8 mature wethers/acre can be carried on improved pastures. On an "improved" natural pasture, up to 6½ wethers/acre were successfully carried through the drought.

In another trial at Shannon Vale, comparing fixed and 4-paddock rotational grazing over a scale of stocking rates (4, 8, and 12 wethers per acre), advantages for the rotational grazing system were shown only at 8 wethers/acre.

At Trangie, lucerne grazing trials were complicated by heavy plant-losses, possibly due to very unusual seasonal circumstances. However, from the results it was obvious that carrying capacity in the area could be greatly increased by the use of lucerne rotationally grazed on a four (or more) paddock system. Set-stocking resulted in rapid mortality of the lucerne stand.

NATURAL PASTURES

Research into the use, composition, and value of natural pastures has increased. On the North Coast, near Grafton, although 4 cwt superphosphate/acre nearly doubled the yield of such pastures, and increased phosphorus and protein yield/acre, the absolute levels of yield were very low compared with those from improved pastures.

In the Narrabri area, rapid recovery of natural pastures following the drought prompted investigations into their productivity. It was found that Mitchell grass produced half a ton of dry matter in four weeks following December rain, but a stocking rate of 1.5 dry sheep/acre on natural pasture compared poorly with a rate of 2.8/acre on lucerne.

PASTURE EXTENSION TRIALS AND DEMONSTRATIONS

U.P.S.E.T. (Uniform Pasture Survey and Extension Trials)

During 1968–69 365 U.P.S.E.T. kits were pre-packaged at the Seed Room, Royal Botanic Gardens, and forwarded to District and research agronomists to help them determine the applicability of research findings to local conditions. Of that total, 130 kits provided material to investigate the use of various fertilizers, 198 were devoted to comparisons of temperate pasture species and cultivars, and a further 37 to comparison of the subtropical plants which are proving of value in the northern parts of the State—especially on the north coast.

Using such pre-packaged pasture species and fertilizer trials, District agronomists have been able to assess the role of new pasture cultivars and of fertilizers in their districts. From them they have gained local data whereon to base pasture

recommendations. U.P.S.E.T. plots have been focal points at numerous field days, and useful sources of factual matter for press, radio, and television components of the extension programmes.

Pasture Demonstration Projects (C.E.S.G.)

Thirty-eight pasture demonstrations, using funds from the Commonwealth Extension Services Grant (C.E.S.G.), were conducted on farmers' properties by District agronomists.

Twelve of the demonstrations compared phalaris varieties in the 10- to 12-inch (April to October) rainfall zone. As a result of these, much interest has been shown in the new Sirocco cultivar of phalaris by farmers who saw the demonstrations at field days, or read and heard associated publicity.

One demonstration featured pasture establishment on the "wallum" health country of the north coast. Other demonstrations variously featured sub-tropical species for a variety of situations, and the use of maize as a cover crop.

PASTURE SEED PRODUCTION

Increased Tonnage

Total production of certified pasture seed in 1968-69 was 1,524 tons, as against 638 tons in the previous year. A considerable quantity of uncertified seed was also produced, including more than 1,000 tons of lucerne seed. The increased production was due mainly to better seasonal conditions in the south and central west. Dry conditions limited production on the south coast and in the northwest.

Certified seed of subterranean clover cultivars totalled 1,385 tons. Of this, over 1,000 tons were of the cultivar Mt Barker—produced in Southern Region.

Kangaroo Valley perennial ryegrass certified seed production was affected both by dry conditions on the south coast and a carry-over of seed from the previous season; 32 tons were produced.

Certified, New South Wales phalaris seed production was reduced due to the deleterious effects of the previous year's drought on the vigour of the stands; 25 tons of seed were

produced. Production of certified seed of other cultivars was maintained; 14 tons of Seedmaster phalaris and 6 tons of Sirocco phalaris.

Demeter fescue certified seed production reached 43 tons and Broadleaf paspalum 8 tons.

Major Objectives Achieved

Two major objectives of a planned programme were substantially achieved:

- (i) To improve varietal purity, further changes were made in procedure for production of seed of several perennial grasses. The changes were also planned to achieve uniformity in procedure between States, and for closer conformity with the Organisation for Economic Co-operation and Development (O.E.C.D.) varietal certification scheme for herbage seeds.
- (ii) to stimulate production of certified seed of *Medicago* spp., arrangements were finalized this year to implement a seed certification scheme in 1969-70 for both Hunter River and Cancreep cultivars of lucerne. Unfortunately, large area sowings of Cancreep lucerne were not possible in 1969, because adverse seasonal conditions and associated technical problems delayed the production of basic seed.

New South Wales Herbage Plant Liaison Committee

This Committee, which includes members representative of merchants and seed producers, continued a significant role in the registration, acceptance and release of new cultivars of herbage plants.

The Committee, with those representing other States, has been active in discussions leading to the decision to seek Australian entry into the O.E.C.D. seed certification scheme. Also, it has continued to accept responsibility for arranging production and maintenance of high quality basic seed stocks of herbage cultivars, and is currently considering means to perpetuate the genotype of these cultivars.

The Commercial Organizations

The Department continues to have excellent co-operation and liaison with the New South Wales Seedgrowers Association, the New South Wales Seedsmen's Association, the New South Wales Seed Increase Committee and the Seed Industry Association of Australia.



Effect of Introduced Pasture Species—North Coast

In contrast with bracken fern infested country in the background, carrying a beast to 20 acres, is the foreground 3 years old pasture of glycine, desmodium and green panic carrying a beast per acre.

Import and Export of Seed

More than 4,000 tons of pasture seed entered Australia through New South Wales ports in 1968-69. The main species imported were red clover, white clover and ryegrasses from New Zealand. Couch grass, bent grass and blue grass seed for lawn sowings were also imported in significant quantities.

Exports of pasture seed, particularly to South American ports, were less than in previous years. Consequently there has been a large carry-over of seed—particularly Mt Barker subterranean clover—normally exported. Sales of Yarloop, Clare and Woogenellup cultivars of subterranean clover were made to southern European countries and there are indications that this trade could expand.

Seed Certification Inspections

An additional Seed Production Officer (formerly known as Seed Certification Officer) was appointed to supplement the seven officers already located at various centres. These officers, and District agronomists, inspected some 47,000 acres and paddock-sealed 34,000 sacks comprising some 517 lots of seed.

Seed Production Research

A research agronomist has been appointed to Tamworth Agricultural Research Station to study physiological aspects of pasture seed production, with particular reference to temperate winter-growing perennial grass species. He will also do field observations on a number of sub-tropical species, to ascertain their potential for seed production under irrigation in the north west.

Inspections Under Various Acts

Three inspectors continued inspections throughout the State under the Agricultural Seeds Act, Stock Foods and Medicines Act, Pest Destroyers Act, Fertilizers Act, and Veterinary Surgeons Act.

They visited 104 towns and suburbs, made routine inspections of 645 stores and 217 special visits, and took a great total of samples.

Unregistered products detected included 487 stock medicines, 111 stock foods, 61 pest destroyers and nine fertilizers. Warnings were sent to those marketing unregistered products in New South Wales.

The inspectors were also engaged part-time on seed certification duties. They completed the final sealing on all certified seed cleaned in Sydney.

SEED TESTING LABORATORY

Conference of the International Seed Testing Association

The Seeds Officer attended the 15th Triennial Conference of the International Seed Testing Association in November, 1968, at Palmerston North, New Zealand. This first occasion of the Conference being held in the Southern Hemisphere included acknowledgement of contributions to seed technology made by Pacific countries.

Laboratory Staff, and Training Matters

The Seed Testing Laboratory started 1968-69 with fifteen established technical positions (three vacant) and ended the year with nineteen positions (two vacant). There were ten resignations and fifteen appointments, and an accumulated loss of 135 man-work weeks, due to long standing vacancies and recruitment problems. The continuing staff-turnover built up a training problem which led to the reclassification of an existing position to Senior Assistant—the occupant to be responsible mainly for supervision of training.

Various aspects of seed testing work and equipment were filmed by a South Korean Government photographer and by the Commonwealth Film Unit for use in educational/training films.

A laboratory technician from Cotton Seed Distributors Ltd of Wee Waa, underwent two periods of training in the Seed Testing Laboratory. The training was designed to familiarize the technician with laboratory management and record systems and to standardize cotton seed testing techniques.

Agricultural Seeds Act

Work on revision of the New South Wales Agricultural Seeds Act and Regulations continued.

Work Statistics

There was a general increase in number of samples received and work performed, but the most significant increase was in arrears at 30th June, 1969. The increase of arrears was in part a build-up of work awaiting check-testing by experienced staff. This type of backlog is a continuing problem, due to the high proportion of inexperienced staff within the Laboratory—stemming from a continuing staff turnover.

Of the 3,172 samples received, some 550 were examined on behalf of the Commonwealth Quarantine Authorities and 1,120 in relation to various Seed Certification standards.

There was 22 per cent increase in pasture seed samples submitted for certification, compared to the previous year. Demands made by the pasture seeds industry on the Laboratory vary according to seasonal conditions; typical of a catch-crop system of seed production.

Samples submitted under the Maize, Sorghum and Bean Seed Certification Schemes, involving the more specialized seed grower, remained stable at 530 samples.

Tests and technical assistance were provided to seed firms, farmers, members of the public, the Police and the Railways Departments, and the Department of Customs and Excise.

The following tabulation provides statistics of seed samples received and tested, including year to year arrears, for the past six years:

Seed Samples Received and Tested Since 1st July, 1963

	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69
Samples received	2,626	3,382	3,139	3,261	2,784	3,172
Arrears	131	153	227	351	259	416
Samples tested, including carryover from previous year	2,583	3,360	3,065	3,137	2,876	3,015
Carryover samples from previous year (Arrears) ..	88	131	153	227	351	259

Fodder Conservation

HAY

The 1967-68 production and stocks of all hay had aggregated 1.3 million tons, the second from lowest total for 10 years past. But although 1968-69 figures are not yet to hand it would appear that in the normal production areas there has been excellent pasture and lucerne growth in the summer, and hay production is expected to exceed 1.5 million tons.

Interest in irrigated lucerne as a commercial hay enterprise has increased. Interest in cereal hay is declining, this hay now being regarded only as a maintenance ration. Pasture hays would appear to be the future mainstay of on-the-farm usage. Prices of prime lucerne hay have declined from the peaks of the drought period, and are varying around \$20 to \$25 a ton on-the-farm.

SILAGE

The 1967-68 silage production and stocks also were the lowest for 10 years, at 365,000 tons, but in the interim the excellent season—in the Riverina and on the southwest slopes especially—has permitted large quantities of silage to be made. Other areas, especially where cattle numbers are high, have reported increased interest in silage. The 1968-69 production and stocks are estimated to have reached 450,000 tons.

Generally greater attention has been paid to silage quality, in realization of the waste involved in feeding low protein, low energy feeds.

Because of rank growth in some areas, there could be trouble from crops ensiled with too high a moisture content. Another trouble source could be variegated thistle ensiled with pastures. Too high a proportion of this could cause stock losses from nitrate poisoning.

Many farmers have employed contractors to cut, cart, and fill their silos. Charges for this have varied from \$1 to \$4 per ton and, where surplus pastures growth has been used, the cheapest fodder possible has been conserved.

GRAIN STORAGE

With heavy production of all feed grains, and the introduction of wheat quotas, interest in on-farm storage methods has increased. Many farmers are considering underground pits.

Engineering firms have enquired about the grain storage position, and several new types of storage units could be on the market soon.

The dairy and beef cattle industries are showing increased interest in feeding grain as a supplement to pastures. There is a considerable dairy industry interest in bulk purchase of feed grains during the summer, and storing these at depots on the coast for sale weekly or monthly to farmers. Schemes are in operation at Bega and several dairy factories in the Taree and Kempsey areas.

Oat grain is very popular with the sheepmen as it is easy to store, cart, and feed, compared to hay and silage. The cattlemen, on the other hand, prefer a bulky feed such as hay or silage—with some grain.

GRAIN DRYING

With the large grain harvests of the past few years (and the Grain Elevators Board insistence on a maximum of 12 per cent moisture content for wheat), the installation of grain driers has increased. This has brought problems, as there is little local practical grain-drying experience. In some cases, where heat has been used, the temperatures applied have been too high and have affected grain quality. In other cases, grain has been dried in batches and the lower levels of the grain have dried satisfactorily but the upper levels have not. This has been due to faulty design and methods. Many farmers storing grain are unaware that moisture migration in "safe" grain is possible and can cause serious losses.

ANALYSIS OF FODDER PRODUCTION

Because of confusion that arises when fodder reserves are variously quoted in terms of tons of hay and silage and of bushels of oats, barley, maize, and sorghum, the fodder position was analysed this year in relation to stock numbers and types. The analysis covered each of the four years from 1965 to 1968 and will continue.

All fodders have been reduced to feed units, and stock have been converted to sheep equivalents. The figures available from this year's estimates indicate twenty-two units available, as against seventeen last year. The twenty-two units are less than half of what is considered a reasonable quantity of stored fodder.

Figures have been taken out for each of the forty-five agronomist Districts, so that a deficiency noted may be acted upon if needs be.

Irrigation

The notable expansion in irrigation over the last three years continued, largely prompted by prevailing dry conditions. With limited water available, and high capital costs, farmers know they must pay appropriate attention to irrigation layout, type of crop produced, and management practice.

The services of the Principal Agronomist (Irrigation) were in constant demand to provide technical guidance to established and potential irrigation farmers, and assistance to the Water Conservation and Irrigation Commission in matters concerned with the development and expansion of irrigation areas and districts.

PROVISIONS FOR RESEARCH

Two irrigation research agronomists have almost completed at the CSIRO Irrigation Research Station, Griffith, a training period concerned with the water needs of maize and a comparison of broad-based furrow irrigation, sprinkler irrigation, sub-irrigation, and trickle (or drip) irrigation.

Acquisition of \$25,000 worth of irrigation equipment from Commonwealth Extension Services Grant funds over the past twelve months will facilitate research on a number of irrigation problems.

FARM WATER SUPPLIES

Landholders' applications for an advance of more than \$4,000 under the Farm Water Supplies Act, for purchase and installation of pumping plants and other equipment, totalled about 130 in 1968-69. Follow-up to this interest in farm water supplies drew the support and co-operation of most District agronomists.

In some areas the development of underground water resources has been spectacular. In other parts the development has been slower, as for example the as yet virtually untapped big areas of suitable underground water defined by the Water Conservation and Irrigation Commission north of Hillston.

Exploitation of underground water has raised difficulties in some areas, where water quality and/or quantity have been disappointing and below the standards needed for irrigation. Continued use of inferior water is causing District agronomists concern because of danger of salting and soil sterilization.

CLOUD SEEDING

The Year's Statistics

The two-plane cloud seeding project continued, from the Cobar and Wagga bases. The operations were aimed primarily at increasing precipitation over potential drought areas. Following are the year's statistics:

	<i>From Cobar</i>	<i>From Wagga</i>
Days flown	117	123
Days seeding	73	86
Hours flown	382	405
Hours seeding	128	154
Seeding time percentage	34	38

Achievements in Cloud Seeding

Visual appraisal of cloud seeding continues to suggest that an increase in rainfall occurred after seeding on many occasions. However, as visual appraisals can be misleading and little credence could be given to such observations by scientific bodies, it is increasingly evident that future analyses of results must be based on rainfall records. To this end a start has been made on a collection of rainfall records on properties in western areas.

Enquiries at the Bureau of Meteorology reveal that only a limited number of recordings for this part of the State are possessed by the Bureau. Accurate figures, many going back to the last century, are kept by some properties, however. Copies of some of these records have already been received or promised.

Training Cloud Seeding Officers

The Cloud Seeding Officer based at Cobar assisted, in association with the CSIRO Division of Radiophysics, in training six cloud seeding officers this year, two from this Department, three from the Victorian Department of Agriculture, and one from the Queensland Department of Primary Industries.

The Hay District agronomist, the Department's relief cloud seeding officer, undertook a further extensive period of training with CSIRO in Tasmania.

Weeds Work

NOXIOUS PLANTS ADMINISTRATION

The good season following the prolonged drought resulted in prolific weed growth throughout the State. Serious outbreaks of unexpected weeds in some cases aggravated the weed control problems of councils. Hay, imported during the drought, was a source of many weeds. Feeding and disposal of unacceptable cereal grains also contributed to the weed load. The added difficulties for councils affected their efficiency in carrying out their obligations under the provisions of the Local Government Act, 1919.

The Noxious Plants Advisory Committee continued effectively to co-ordinate noxious plant matters between the Department of Agriculture, Local Government, and Lands, and the local government bodies.

The State Government again made \$400,000 available by way of grants to assist councils' noxious plant control programmes. Most of this was allocated on a dollar for dollar basis to assist in the control of the most serious noxious plants on council-owned and public lands, and for the inspection of all lands by weed inspectors. In the Western Division shires of Brewarrina, Cobar and Darling, grants were made on the basis of \$2 for \$1.

Because of the volume of requests for aid, all councils received substantially less than requested. Special grants were made for the control of specified weeds on vacant Crown lands.

Transition of the Far North Coast County Council into an "all weeds" County Council is under consideration.

A review of the noxious plant declarations (and establishment of priorities for the areas to be reviewed) has been prepared. The purpose is a more uniform approach to the declaration of noxious plants.

Education of council weeds officers is receiving attention, by means of a weeds newsletter and the development of an in-service training scheme.

EXTENSION SERVICES IN WEED CONTROL

Appointment of five Field Officers (Weeds) has been planned. Three of these have already been appointed, to assist District agronomists and local government bodies on technical aspects of noxious plant and weed control.

The New South Wales Weeds Society conducted in May a symposium on woody weeds at the University of New South Wales. It was part of the "Sheep and Wool Improvement School" conducted by the University School of Wool and Pastoral Sciences in conjunction with the Institute of Rural Technology. Officers of the Department's Weeds Section assisted in planning and organizing the Symposium.

SPECIAL INVESTIGATIONS

Field Officers (Weeds) investigated weed seeds in grain throughout the north west, the nodding thistle (*Carduus nutans*) outbreak at Crookwell, and the occurrence of wild cotton bush (*Asclepias physocarpa*) at Nymboida.

THE WEEDS SITUATION

Galvanized burr (*Bassia burchii*) is a special problem. This weed has spread rapidly since the drought and has reached worrying proportions for many people; in the Western Division and a western part of the Central Division. The most likely economic method of control of galvanized burr is through the application of ecological principles.

To this end, the Department has approached the Australian Wool Board for funds for a post-graduate training position in ecology with the CSIRO, with particular reference to the ecology of galvanized burr.

Other problems of importance are woody weeds, including: lantana (*Lantana camera*), blackberry (*Rubus fruticosus*), groundsel bush (*Baccharis halmifolia*), crofton weed (*Eupatorium riparium*) and tree tobacco (*Nicotiana glauca*). Each of these is widespread on the coast.

The insect *Plagiohammus* sp., which has shown promise for biological control of lantana in Hawaii, has been increased by the CSIRO and is to be released under field conditions this season.

In the west, cypress pine seedlings (*Callitris* spp.), bumble box (*Eucalyptus populifolia*), budda (*Eremophila mitchellii*), turpentine bush (*Eremophila sturtii*), punty (*Cassia nemophila*), hopbush (*Dodonaea viscosa*) and, in parts, mesquite (*Prosopis juliflora*) and African boxthorn (*Lycium ferocissimum*) are proving very troublesome.

Of the broad-leaved plants, skeleton weed (*Chondrilla juncea*), mintweed (*Salvia reflexa*), black bindweed (*Polygonum convolvulus*), spiny emex (*Emex australis*), and fumitory (*Fumaria* spp.) are prevalent. But they are being treated satisfactorily with the newer herbicides. Soursob (*Oxalis pes-caprae*) and silver-leaved nightshade (*Solanum elaeagnifolium*)

are spreading and their control is proving difficult. Sheep's sorrel (*Rumex acetosella*) is widespread in pastures but it is possible the herbicide dicamba may give successful control in seed production situations.

Noogoora and Bathurst burrs (*Xanthium* spp.) have flourished after the drought and are causing difficulty with stock movement into South Australia. Paterson's curse (*Echium plantagineum*) has thickened up in the southern part of the State and is proving difficult to control. Horehound is reported to be causing trouble in isolated outbreaks.

A cause for major concern is nodding thistle (*C. natans*) and other thistles which have increased greatly due to the breakdown of pastures on the tablelands and adjacent western slopes during recent drought years.

The weed grasses are causing serious economic losses in most crops and in some instances, in pasture. Wild oats (*Avena fatua* and *A. ludoviciana*) are causing serious economic losses to wheat farmers, particularly in the northern half of the State. Pre-emergence control methods are favoured but significant numbers of farmers have not yet fully accepted control recommendations. Wimmera ryegrass (*Lolium rigidum*) is of concern in the southern half of the State. In some northern areas *Phalaris paradoxa* is of importance in wheat.

In summer crops, barnyard grass (*Echinochloa colonum*) has caused concern and has spread into the new Coleambally Irrigation Area. Barley grass (*Hordeum leporinum*) is a widespread nuisance in pastures and lucerne.

Serrated tussock (*Nassella trichotoma*) infestations have been greatly reduced using the techniques of aerial spraying followed by pasture improvement.

Of the aquatic weeds, cumbungi (*Typha* spp.) and water hyacinth (*Eichhornia crassipes*) are receiving adequate attention.

Eradication of the drug plant Indian hemp (*Cannabis sativa*) continued. Only a few plants were found. Infestations are now confined to isolated, disturbed situations.

WEED RESEARCH

Two new research agronomist (weeds) positions were created this year. There are now seven such positions within the Division of Plant Industry. Two are vacant.

Research was continued within existing programmes.

The research officer previously located at Bathurst Agricultural Research Station is still on study leave at the University of New England. Maintenance of established pasture on country retrieved from serrated tussock infestation has received attention in his absence.

Weeds research at Hawkesbury Agricultural College was largely re-orientated to develop a project on total vegetation control. Initially this has involved discussions and examination of a number of situations typical of those encountered by Government departments involved in weed control.

At Tamworth Agricultural Research Station some work with vegetables was undertaken, to finalize aspects of weed control in several important row-crops; potatoes, tomatoes and sweet corn in particular.

Wild Oats Research, Tamworth.—Work on wild oats was continued at Tamworth Agricultural Research Station. It comprised (i) *Spray pattern studies*; (ii) *Competition studies*. These "spray pattern studies" indicated that dose rates on grasses can be reduced by as much as 66 per cent, by using correct spray patterns. Field trials, using the wild oat control herbicide barban, indicated that when spray patterns are adjusted a reduced volume can deposit as much as three times the amount of herbicide as that from current standard techniques. The "competition studies" showed *inter alia* that an infestation of 600 wild oats per square yard reduces wheat yield by 70 per cent and that infestations of 600 to 800 wild oat plants per square yard are not uncommon. Seemingly, wheat yield losses caused by wild oats are very great State-wide.

Crofton Weed Research, Wollongbar.—The Wollongbar Agricultural Research Station weeds research agronomist has presented his work on crofton weed (*E. riparium*) as a thesis for the M.Sc.Agr. degree. His results are also in articles to be published in the *Agricultural Gazette*.

Screening trials involving all the commonly used or company-recommended herbicides have established the merits of 2,4-D, applied in spring, as the most economical product for crofton weed control.



Rack-spraying Developed for Sultana-drying

Rack-spraying with the dip-fluid has been developed at Dareton Horticultural Research Station and, with very clear advantages in terms of costs and product quality, is rapidly replacing dipping as the growers' method of sultana-drying.

Eragrostis Survey, Tenterfield.—A special survey of *Eragrostis curvula* in the Tenterfield district was launched, to determine the ecological factors concerned in its invasion of pastures.

Several herbicides were tested on *Eragrostis curvula* at Tenterfield. Good kills were achieved by reasonably low rates of 2,2-DPA but seedling regeneration occurred. In itself, chemical spraying is not sufficient to eradicate the weed from pasture situations.

Irrigation Weeds, M.I.A.—At Yanco Agricultural College and Research Station the weeds work has been concentrated in three fields: (i) Initial competition studies of the weed dirty dora (*Cyperus* sp.), indicate it can reduce rice yields by as much as 40 per cent; (ii) Pre-emergence weed control in onions has advanced to the point where the most promising few herbicides can be selected for detailed testing; (iii) Trials with molinate to control barnyard grass in rice have ended, and significant district use of the herbicide is already evident.

Boxthorn Control, Parkes.—A District trial at Parkes compared several herbicides for boxthorn control. This work indicated bromacil as an effective means of killing small bushes (up to 6ft to 7 ft diameter of spread) at a lower cost than fenuron.

Sifting Bush, Temora.—At Temora, trials to determine the economics and efficacy of picloram on sifting bush (*Cassinia arctuata*) showed that control could be achieved—but at an unacceptable cost.

Other Research Lines.—Other weed control investigations were done at Narrabri Agricultural Research Station, on herbicide residues in soil; at Bathurst Agricultural Research Station, on tolerance of apples to herbicides; at Yanco Agricultural College and Research Station, Narara Horticultural Research Station, and Dareton Horticultural Research Station, on weed control in citrus; at Alstonville Tropical Research Station, on weed control in bananas and pineapples; and at Glen Innes Agricultural Research Station, on weed control in tobacco. Results have yet to be finalized.

REGISTRATION OF NEW HERBICIDES

Consideration of applications for registration of new herbicides was a significant function of the Weeds Section. Whilst only five herbicides were recommended for registration this year, a number of others were investigated. There are now

more than sixty registered separate chemical compounds used as herbicides. The five newly added to the list this year were: *pebulate*—for nutgrass control in tobacco; *dichlobenil*—for control of weeds in nurseries, control of some aquatic weeds, and control of wild oats in wheat; *nitratin*—for grass control in cotton; *pyramin*—for weed control in beetroot; *terbacil*—for weed control in apples and peaches.

DIVISION OF HORTICULTURE

General

STAFF

Administrative Positions

Mr R. Sweedman was promoted to the vacant position of Assistant Principal Fruit Officer (Extension), and Mr D. Leggo was promoted to a newly established position of Assistant Principal Fruit Officer (Research).

Research Positions

Six Fruit Officers (Research) were appointed this year, but in the establishment strength of twenty-two research officers there are still three vacancies; one at the Citrus Wastage Research Laboratory, Gosford, one at Yanco Agricultural College and Research Station, and one at head office.

One research officer is full-time in post-graduate studies at the University of Sydney, for the Doctor of Philosophy degree. Four research officers are working for Master degrees as external post-graduate students.

Extension Positions

Six Fruit Officers were recruited and for the first time in many years the Division's extension staff establishment is at full strength. However, it is notable that, excluding senior administrative officers, fourteen of the remaining thirty-four extension officers are still in their training and development period. All but one of the fourteen have less than three years' experience.

Three fruit officer Districts are vacant; Armidale (since 2/10/68), Griffith No. 1 (since 17/6/68), and Leeton No. 2 (since 12/7/68). Arrangements have been made to fill two of these during 1969-70. A new District, for a Fruit Officer (Extension), has been established and filled at East Maitland. *Inter alia* this will service the rapidly expanding wine grape industry in the Region.

A new position of Fruit Officer (Orchardist) was established also at the Orange Agricultural Research Station, for management of the permanent experimental plantings developing at this recently established institution.

Regulatory Positions

Ten Inspectors (Plant Diseases Act) were recruited, but, on the other hand, eight were lost by transfer or resignation. Nine Regulatory Assistants were appointed. Four of these were gained by transfer and promotion from other positions.

The position of OIC of the Plant Quarantine Station was filled by appointing a Fruit Officer to it. Six new Inspector (P.D. Act) positions were established, mainly for quarantine duties, and one Regulatory Assistant position was established for the Plant Quarantine Station. Establishment of four more Inspector (P.D. Act) positions is in process.

Two regulatory positions have been reclassified as Supervisory Inspector (P.D. Act); one to be Inspector-in-Charge, Sydney City Markets, and the other to be Inspector-in-Charge, Newcastle. A new District inspectorate was created at Inverell—by transfer of the Broken Hill position. The latter area is now attached to the Dareton inspectorate.

At 30th June, 1969, seven Inspector (P.D. Act) positions were vacant.

Overseas Visits and Studies

By invitation from the South Pacific Commission, Principal Fruit Officer (Tropical Fruits) Mr D. S. Leigh attended in consultant capacity the Technical Conference on Banana Production in Tonga in December, 1968. Delegates and observers from Fiji, Western Samoa, Cook Islands, Tonga, Noumea, New Zealand and Hawaii attended. The Conference's main objective was to assemble material for a *Handbook on Banana Culture and Marketing in the South Pacific Islands* for use by extension officers working in these areas.

Fruit Officer (Research) Mr D. W. Turner, of the Tropical Fruit Research Station, Alstonville, did a study tour of overseas banana growing countries from January to March, 1969. This was to appraise overseas field trial and research methods, study banana plant physiology, investigate crop control methods, and explore the use of leaf analysis in relation to fertilizer recommendations. He made valuable professional contacts.

PACIFIC ASIAN INTERCHANGE IN BANANA CULTURE

Division of Horticulture had a major role in organization of the Pacific Asian Interchange in Banana Culture sponsored jointly by various Australian authorities in conjunction with the East-West Centre of the University of Hawaii. The Interchange was the first held in Australia as a project of the East-West Centre. Coffs Harbour, N.S.W., was venue of the first segment. The Interchange concluded in Queensland during May, 1969. Fifteen Asian and the South Pacific countries within the scope of the East-West Centre, Colombo Plan and South Pacific Technical Assistance Programmes participated.

COMMONWEALTH AND STATES HORTICULTURAL COMMITTEE

By decision of the Standing Committee on Agriculture, the Commonwealth and States Horticultural Committee was inaugurated. This is in effect a permanent Sub-Committee of Standing Committee; comprising the Chief Horticulturists of State Departments of Agriculture and a representative each from the Commonwealth Department of Health, Department of Primary Industry and the CSIRO.

The Committee will consider and advise Standing Committee on such horticultural matters as fruit and vegetable production and research; post-harvest storage, packaging, and transport research; horticultural research conferences; fruit and vegetable disinfection treatment; fruit and vegetable variety introductions; and interstate plant quarantine.

AUSTRALIAN FRUIT AND VEGETABLE STORAGE RESEARCH CONFERENCE

Seven Division of Horticulture officers and one each from the Division of Plant Industry and Division of Science Services attended the Fifth Australian Fruit and Vegetable Storage Research Conference, held at the University of Tasmania. The Department of Primary Industry, the CSIRO, New Zealand Department of Scientific and Industrial Research, and all State Departments of Agriculture were represented.

These conferences review progress in recent fruit and vegetable storage research, and assist liaison between the workers in the various research organizations throughout Australia and New Zealand. Subjects in the 5th Conference programme included: effect of cultural practices on storage quality, controlled atmosphere storage, fungal and physiological disorders, and technical problems in retail packaging.

COMMITTEE ON HOME MAINTENANCE AREAS FOR HORTICULTURAL HOLDINGS

An inter-Departmental Committee comprising three officers of the N.S.W. Water Conservation and Irrigation Commission and two officers of the Division of Horticulture has been set up by the Minister for Conservation, with the concurrence of the Minister for Agriculture, on representations made by various fruitgrowing organizations. The latter want an increase in the maximum area of fruit crops landholders may irrigate in irrigation areas, or elsewhere in the State by private diversions under licence or authority of the Water Act.

SENATE SELECT COMMITTEE INQUIRY ON AIR POLLUTION

At the request of the N.S.W. Citrus Growers Council, the Principal Fruit Officer (Citrus) presented a paper, "The Effects of Air Pollution on Fruit Crops", at the Senate Select Committee Inquiry on Air Pollution in March, 1969. The statement dealt with smog and gaseous pollutants, but emphasized the effects of dust—its effects on tree health, biological control of insects, and the contamination of fresh and dried fruits.

Research for the Fruit Industries

RESEARCH—POME FRUIT INDUSTRIES

Rootstock Trials

Apples.—Three complementary trials at Research Stations (Bathurst, Yanco, and Glen Innes) are evaluating a series of Merton Malling rootstocks. Most of these resulted in semi-dwarf trees—a positive means of reducing production costs. Average age of the trials is 9 years.

Useful field observations so far include these: MM102 produces trees markedly smaller than all other stocks; many trees are poorly anchored compared with those on seedling stocks and will need some staking; MM110, though not recommended overseas, is showing promise under N.S.W. conditions.

Pears.—At Bathurst, trials are comparing the Italian stock *Pyrus betulaefolia* with the standard recommended stock *Pyrus calleryana* (D6), and another is examining the potential value of quince as a stock to produce semi-dwarf trees.

In the latter trial more than half the trees of three varieties have died through incompatibility, and one tree each of the two varieties which have been growing well—Williams and Winter Cole—have been lost due to structural weakness at the bud union. However, using the same quince rootstock but with an intermediate stem piece of Beurre Hardy, trees are growing well—especially the Williams variety.

Vegetative Propagation of Rootstocks

Continued attempts are being made to propagate both softwood and hardwood apple cuttings at Bathurst. Vegetative propagation of rootstocks by stooling or layering as practised by industry is laborious and costly.

Efforts will be made to propagate juvenile softwood cuttings taken throughout the season. Dormant hardwood cuttings are currently being tried—using bottom heat of about 68°F, together with hormone treatments—in specially prepared beds where the cuttings' aboveground parts are subjected to normal winter temperatures and not glasshouse conditions.

Herbicide Trials

Two trials at Bathurst are to ascertain the long-term effects of herbicides on apple tree health; one trial using mature and the other using young trees. Applications at rates up to three times greater than commercially recommended have been applied annually for 3 years.

Toxicity symptoms developed this season where diuron has been used at the higher rates. On the other hand, there have been actual growth responses by young trees where high rates of simazine continue to be used.

Introduction of New Varieties

Promising varieties are introduced from overseas to provide local industry with a wider range of pome fruits. This year four cider varieties from England were imported and are undergoing quarantine.

The New Zealand apple Splendour was released from quarantine last year and a number of trees have been propagated for field testing. A spur-bearing Golden Delicious is almost due for release from quarantine. Arrangements have been made, also, to propagate several trees of the early-maturing English apple Tydeman's Early—from grafting wood supplied by the Tasmanian Department of Agriculture.

Apple Maturity Studies

For some years there has been conflict on the desirability of exporting very early Granny Smith apples from N.S.W. and Queensland, when very high prices are realized. Arguments against the earliest shipments have related to the possibilities of poor out-turn, and consequent detriment to the later bigger shipments.

To get reliable data as to when export shipments should start, a trial was undertaken—for closer examination of inter-district differences in maturity of Granny Smith apples. Apples from nine districts were harvested and subjected to a maturity test before storage, then examined for post-storage disorders and tested for palatability. The storage conditions were designed to simulate an average export shipment from N.S.W. to the U.K.

Progress results, from using the starch iodine test of maturity, indicate no significant differences between districts in the rates of Granny Smith ripening. There was very little bitter pit, and virtually no scald, and all fruit tasted was generally acceptable. Repeat of this work in 1970 has been programmed.

Packham Triumph Pears Fruit-set

In a series of fruit-set studies on Packham Triumph pears, gibberellic acid sprays within a few days of frost damage were not as effective as adequate hand-pollination.

Sprays with proprietary material alar, applied to inadequately pollinated pears to induce parthenocarpic fruit development, could not be fully assessed due to frost damage. But a further series of alar sprays, applied after the frosts, indicated increased fruit set. Increased total fruit was harvested, and per fruit weight average was reduced.

Weight Loss Effect on Incidence of Apple Internal Breakdown

North Ryde Laboratory has established a decreasing incidence of breakdown, during storage, in fruit subjected to increased weight loss. Similar investigations done also in New Zealand by an officer of this Division in association with the Fruit Research Division of the N.Z. D.S.I.R. appear to substantiate this finding.

A paper has been published this year on breakdown and weight loss of Red Jonathan apples in controlled atmosphere (C.A.) storage.

Relative to these findings, pilot tests have indicated that dipping apples in alkaline solutions before storage increases weight loss. Using potassium carbonate in the dip, weight loss can be increased by about 50 per cent without significant fruit injury.

C.A. Storage—Plastic "Tent" and External Generator

In association with this Department's Research Stations Branch, a plastic tent to hold 1,500 bushels of apples has been constructed, and an open-flame type atmospheric genera-

tor has been built. These have been installed in a commercial orchard's cool store, and data on their performance are being obtained.

Pears and Apples; Post-Harvest Fungicides

Chemicals of the benzimidazole group have been screened for their effect on post-harvest diseases. Wastage of apples and pears caused by *Penicillium expansum* and *Botrytis cinerea* has been significantly reduced by post-harvest dips in thiabendazole, benomyl and parabendazole. The fungicides' effectiveness was not reduced by combining with scald control dips.

Economics of Fruit Cool Stores

Schedules are being constructed to determine the establishment and associated running costs of different types of cool stores. Overheads such as depreciation, interest and insurance, and operating costs such as electricity and machinery and store maintenance are being studied. Also in the cost schedules are product-handling phases such as bulk bins, fork lift trucks, and dipping equipment.

RESEARCH—CITRUS INDUSTRIES

Effects of Double Planting

A Valencia orange double-spacing trial planted in 1960 at the Horticultural Research Station, Dareton, is in two blocks; one using sweet orange rootstock for permanent and inter-plant trees; the other using sweet orange stock for permanent trees, and trifoliata stocks for the interplants.

The original concept was to allow three times of thinning the double planted (24 ft x 12 ft) treatments to be compared with normal spacing (24 ft x 24 ft) in each block. This concept has been maintained for the sweet orange/trifoliata block, and the first thinning of trifoliata interplants was made last spring. At this stage the trifoliata interplants had not interfered with the size of the permanent trees on sweet orange.

Some competition effects are beginning to show on the double-planted trees on sweet orange stock, but so far the double planting has resulted in twice the yield of oranges per acre—compared to normal spaced trees—even though fertilizer and water have been supplied on an acreage rather than a tree basis.

While the competition for water has become apparent, and differential irrigation treatments will be now included in the programme to compensate for this increased competition, the double-planted trees have shown greater ability to utilize the fertilizer applied and only a small drop in the leaf nutrient levels can be detected between double and single spaced trees.

From the 1969 spring, one section of the trial, where all trees are on sweet orange stock, will be used to compare hedging methods. The two forms of hedge treatments will be a high and narrow rectangle and an isosceles or truncated triangle.

Root Distribution Study

A root distribution study at Dareton compared the normally spaced and double-planted Valencia orange trees, to determine why with uniform fertilizer applications per acre there was not a marked reduction in leaf nutrient levels in the double-planted trees. The conclusion was double-planted trees made more effective use of the available soil than single-planted trees and, although the roots in each case grew downwards and outwards in a conical shape, the soil between trees was more effectively utilized in the double-planted plots.

Hormone Effect on Rind Quality

At the Narara Horticultural Research Station, a comprehensive range of gibberellic acid (G.A.) treatments was applied to navel oranges to examine fruit quality effects. No effect on internal fruit quality or on fruit drop was recorded, and the rind of G.A. treated fruit was less susceptible to injury. The benefit seemed to be increased by higher G.A. concentration. Also, mould wastage during post-harvest storage was significantly reduced by G.A. treatments. However, G.A. sprays resulted in less intense orange colour. It was not a serious defect as noted in previous work with Valencias—where G.A. induced regreening.



Herbicide Management of Citrus

Widespread trials and demonstrations have shown herbicides to be an effective alternative to cultivation for weed control in citrus; and a big saving on the labour costs of conventional cultivation.

Navel Orange Nitrogen Fertilizer Trial

Since 1952 differential nitrogen fertilizer treatments have been applied to a mature block of Washington navel oranges on rough lemon stock at Yanco Agricultural College and Research Station. In 1961 the plots were split to include superphosphate applications.

Yield over the 8 years since the superphosphate treatments began has been highest (496 lb per tree per annum) where 8 lb sulphate of ammonia has been applied annually; as compared with 472 lb per tree per annum with 4 lb sulphate of ammonia. The lowest yielding trees (357 lb) were those receiving no fertilizer and these are becoming weaker and more unthrifty.

There has been very little evidence of benefit from high rates of superphosphate application; little rise in leaf phosphate levels, and no effect on yield. Although superphosphate has had no effect on skin texture, rind thickness has decreased slightly.

This year, lime was applied to bring soil pH in all plots back to a common level at 6.0. The higher pH may increase the availability of phosphate to the trees.

Herbicide Management Trials

Herbicide management trials were continued at Dareton, Yanco and Narara, to demonstrate herbicide sprays as an alternative cultural method to cultivation. The trials have greatly aided commercial adoption and have demonstrated that various chemicals are satisfactory—the preference varying with soil type, weed problem, topography and local climate.

High-rate Trial at Dareton.—In this there was tree injury in autumn, 1969; after three annual 10 lb diuron applications. Salt injury in the previous season could have predisposed the herbicide injury; the trees have now recovered and high rates will be recommended in 1969–70. Barrel medic has been included in the trial as a winter cover crop, to be sprayed with herbicide in the spring and left as a summer surface mulch. This will be compared with the normal, clean cultivation treatment during summer and barrel medic winter cover crop, and with “blanket application” of herbicide—spring and autumn—to disallow weed growth.

At Yanco on Clay Loam, with Furrow Irrigation.—This trial is comparing with clean summer cultivation and winter cover crop of volunteer weeds, the paraquat treatments (paraquat

applied several times during the growing season) and, also, treatments comprising spring and autumn applications of terbacil, bromacil and diuron. Herbicide rates in this trial are reduced as the weed population decreases.

All of the “blanket” pre-emergence treatments appear satisfactory. The economics of application will possibly determine the best treatment. Repeated “knockdown” treatments with paraquat have been very costly, because of the needed frequency.

At Yanco, on Sandhill Soil with Spray Irrigation.—This trial is comparing with hand-hoeing the herbicides terbacil, bromacil, and diuron. The herbicides have been applied in 6 ft strips down the tree row, with the inter-row space sown to subterranean clover. The latter will be allowed to hay down during summer.

The three chemicals have given satisfactory control, although with bromacil and terbacil some leaching has occurred in areas of deep sand. Diuron has not been as effective against couch grass and skeleton weed; and spot treatments with bromacil have been necessary—an effective way of sustaining the more economic diuron treatment.

At Somersby.—Here the greater tendency of bromacil to leach from the soil was apparent. Crab grass started to grow, between spring and autumn applications, whereas diuron maintained control. However, bromacil in initial applications gave the better control of weeds.

This also indicated that diuron would be the more economic treatment, provided problem weeds were maintained.

No adverse effect on tree health with high rate trials of bromacil and diuron has occurred at Somersby.

Dwarf Tree Investigations

Close planting of dwarf orange trees is being examined in several large trial plantings at Yanco. One trial involves navels (1963 planting) and Valencias (1964 planting) on trifoliata rootstock, where several dwarfing budlines are being compared in a close planting of 17 ft x 7 ft 4 in (350 trees per acre).

The navel trees in 1968—their first crop year—yielded over a bushel per tree and will exceed this in 1969, a very high return per acre for young trees. The Valencias, this year to be harvested for the first time, have been estimated as carrying well over one bushel per tree. Some differences are also evident between the dwarfing selections.

In another section of the experiment, rootstocks of Carrizo and Troyer citrange are being compared with trifoliata stocks, using several dwarfing budlines. Early indications are that the dwarfing effects are not as great on citranges as with trifoliata. In their first crop year the Carrizo yielded 250 cases per acre, the Troyer 280 cases per acre, and trifoliata 140 cases per acre.

Post-Harvest Mould Control

Thiabendazole (TBZ) and benomyl, (benlate) were compared with the standard fungicidal treatments for export citrus fruit (double SOPP treatment and diphenyl wraps or pads). This was with Valencia oranges, at the Gosford Citrus Wastage Research Laboratory. The fruit was cool stored at 45° F for six to eight weeks, to simulate export conditions, and examined for wastage after holding at ambient temperatures for a week following storage.

Both benomyl and TBZ (dried on to the fruit following washing) were more effective than the combinations of SOPP and diphenyl against green mould (*Penicillium digitatum*) and total wastage.

With Emperor mandarins, benomyl, TBZ and SOPP were all effective in reducing wastage, mainly caused by green mould during storage.

Through world shortage of SOPP, some packing houses have exhausted their supplies of this fungicide. Since health authorities have approved the use of TBZ as a post-harvest fungicide for citrus, a test of TBZ as an alternative to SOPP in the wash tank was arranged in a commercial packing house. Following this, the use of TBZ in N.S.W., as a two-minute dip in 0.1 per cent suspension, followed by a clean water rinse, has been provisionally recommended.

Lemon Storage

In an experiment wherein Eureka lemons were stored for four to five months, benomyl (dried on to the fruit) was more effective than TBZ for control of stem-end rot (*Phomopsis citri*) and green mould. Wastage control with TBZ in combination with 500 ppm 2,4-D in wax was better than with the previously recommended sodium salicylanilide and 2,4-D in wax.

Citrus Rind Blemish

Following requests from the Central Coast Agricultural Research and Extension Committee, and with funds from the Commonwealth, a research officer has been appointed for work to reduce rind blemish and improve the attractiveness of coastal citrus. Because of blemish, the coastal citrus fruit prices suffer, although internal quality is equal to that of inland fruit.

RESEARCH—TROPICAL FRUIT INDUSTRIES

Banana Nutrition

Field Nutrition Trial.—Data from the banana field nutrition trial at Alstonville Tropical Fruit Research Station are being calibrated for climatic variation and natural fertility gradients. This, if successful, will provide invaluable information for the design and conduct of future field experiments with bananas.

Large pots (Lysimeters) have been installed, some planted with bananas to test growth under conditions of sand culture, before starting a full-scale investigation into nutrient relations in the forthcoming season.

Magnesium.—Leaf sampling from field trial plots continued. As a result, symptoms are now confidently used to assess magnesium deficiency in the field.

Banana Plant Growth Studies

Studies at Alstonville on the relationship between yield and the duration of leaf area have shown that the banana plant needs at least 3-4 leaves at bunch-emergence to carry the bunch through to commercial maturity. Covering the bunches with P.V.C. plastic reduces the leaf numbers needed for level of yield.

A controlled-environment growth chamber has now been installed at Alstonville. Trials to observe the effects of various temperature and light regimes on leaf emergence rates are proceeding.

Banana Plant/Soil Moisture Relationships

Plant physiology in relation to irrigation needs was further investigated, using black polyethylene sheeting to cover soil around the plants to be water-stressed. Stress beyond wilting point reduced the percentage dry matter of roots by 50 per cent, and forced penetration beyond the surface 12 inch root zone. Water stress has reduced plant growth, and the effects on yield and quality are being evaluated.

Dipping to Control Squirter and Black-End

Health authorities' approval of a residue tolerance for thiabendazole in bananas in N.S.W. has been followed by field trials on four plantations, using a commercial preparation. The work is in co-operation with the Biology and Chemistry Branches. It is to determine limits of concentration and effective dip life of the material, for control of squirter and black-end.

Polyethylene Bags for Banana Transport

A successful long distance trial with bananas in polyethylene bags, from North Queensland and Coff's Harbour, N.S.W., to Adelaide, S.A., was carried out with the co-operation of the South Australian Department of Agriculture and the Queensland Department of Primary Industries. The ethylene absorbent (potassium permanganate) method as previously developed was the most satisfactory.

An important result was lack of mechanical injury to fruit held in polyethylene bags, as compared with injury in the commercial-hand pack, injury attributed mainly to movement within the package after wilting of the fruit.

Bananas Sterilization Against Fruit Fly

Ethylene Dibromide (E.D.B.) Fumigation.—Earlier work at the Citrus Wastage Research Laboratory, Gosford, showed that the skin of winter fruit was blackened at the dosage of 14 oz E.D.B. per 1,000 cu ft at 70° F, whilst the dosage gave promise of extremely high fruit fly mortality—and was tolerated by summer-grown bananas.

The skin-injury effect of E.D.B. has been further investigated. Rates ranging from 10–15 oz E.D.B. per 1,000 cu ft at 70° F were successful on summer fruit. If doses in the order of 12 oz per 1,000 cu ft prove safe on winter fruit, insect mortality at this dosage will be studied.

Insecticidal Dip Treatments.—Very high mortality of fruit fly eggs and of larvae were demonstrated when artificially-infested bananas were dipped in 0.03 per cent dimethoate at 70° F for up to three minutes. There were two surviving pupae from 89,153 larvae treated, and no survivor from 102,251 eggs treated. Reduction of dip time to 10 seconds, and varying the dip temperature between 50° and 70° F, did not markedly reduce the effectiveness of the insecticide or its activity.

Combination of either salicylanilide and thiabendazole in a dip with the dimethoate was slightly less effective than dimethoate alone.

No evidence of skin injury has been observed, and use of dimethoate against fruit fly to attain the security levels set by the Japanese quarantine authorities is now being studied.

Pineapples

Pre-planting Insecticidal Treatment.—A pre-planting treatment with a range of insecticides to control the root-attacking pasture scarab beetle *Rhagoia* sp. is on trial.

Mulching Trial.—A mulching trial wherein plastic sheeting and grass clippings are being compared, in relation to plant growth and yield, is proceeding.

RESEARCH—GRAPE INDUSTRIES

Pruning, Training and Spacing of Wine Grapes

At Griffith Viticultural Research Station further data were obtained from the pruning, training and spacing experiments planted in 1962:

Black Shiraz.—The earlier reported yield responses to the 15 inch T-trellis, as compared with the standard single wire trellis, were not maintained this season. There was no significant yield difference between any of the eight treatments comparing four pruning methods and two trellising methods. The

likely explanation is that with age, the inner fruiting-wood of the T-trellis vines has been shaded out. A wider T would be needed.

Semillon.—As with Black Shiraz, the response to T-trellis has begun to decline; although yield difference between the two trellising methods is still significant.

Gordo Blanco.—As in previous years, because of high fruitfulness of basal buds, the number of buds retained on year-old wood has had no effect on yield and there was no response to T-trellis. However, vines planted 4 feet apart in the rows continued to outyield on a per acre basis those planted 7 feet apart.

Clonal Selection and Introductions

A comprehensive clonal selection programme for wine grapes was started this year. The potential of such a programme has been illustrated in an earlier planting of Black Shiraz vines at the Griffith Station, with consistent and significant yield differences of up to 50 per cent between sets of vines propagated from different mother vines.

This year, 120 candidate clones of Black Shiraz and Semillon were selected from Hunter Valley and M.I.A. vineyards. These will be planted at the Viticultural Research Station, Griffith, for testing. Several of the promising selections had yielded in non-irrigated Hunter Valley vineyards at 8 tons per acre for Semillon and 6 tons per acre for Black Shiraz.

Also, forty-one high performance clones were in a collection imported from France, Germany and Switzerland. These are now in quarantine undergoing virus indexing.

Irrigation Frequency and Timing

At the Griffith Station treatments in the Black Shiraz irrigation trial were applied for the third season. Infrequent irrigation in times of high evaporative demand produced plant water deficits. These reduced vegetative and fruit growth. Unsuccessful use was made of a leaf relative-turgidity method to assess plant water deficits. A pressure chamber method was successful.

Radiation Environment

By computer, rectangular and truncated triangle models have been developed to examine radiation interception by vines. This season, photo-synthetic capacities of Black Shiraz canopies were estimated with descriptive model. These and other results indicate that present trellising arrangements—at least for vigorous varieties—provide inefficient light utilization.

Excellent co-operation in this and other fields between officers stationed at Griffith Viticultural Research Station and CSIRO officers has been maintained. A joint publication on parameters effecting photosynthesis in vines has been prepared.

Nematode Resistant Rootstock Trials

Two rootstock trials comparing the effects of nematode resistant and *Phylloxera*-resistant rootstocks on vine health and production have now been planted; one at the Horticultural Research Station, Dareton (*Gordo Blanco* scion) and the other at Griffith Viticultural Research Station (*Black Shiraz* scion).

Gibberellic Acid, Thinning for Table Grape Quality

Promising former results by thinning with G.A. to improve the quality of Black Muscat grape bunches on a private Wedderburn vineyard were not repeated this season. Thinning was excessive in all treatments, possibly because of unfavourable weather at flowering.

Pruning of Young Grape Vines

Effects of three different pruning methods, on the formation and cropping of young *Gordo Blanco* vines, are being studied at the Horticultural Research Station, Dareton. Vine formation and cropping seem to have been accelerated by forming spurs in the trellising year.

Rack Spraying

Rack spraying with the dip solution, to accelerate sultana drying, was compared with the normal dipping method at Dareton. Fruit so treated dried more rapidly, under this season's adverse harvest conditions.

The method would substantially reduce labour and costs, and cleaner fruit would be expected. Pick-up of grit by dip tins, and contamination of the fruit with grit in the bulk dip tank, would be avoided.

RESEARCH—STONE FRUIT INDUSTRIES

Variety Trials

Canning Fruit.—A recent introduction ("*Jan Neethling*"), also three locally bred selections and three late varieties have been added to the peach varieties (total now forty-one) under trial at Yanco Agricultural College and Research Station.

Canned samples of thirty-six varieties were evaluated at a Canning Peach Conference held in August, when the two mutant Golden Queen selections "*Yanco Queen*" (early) and "*Taylor Queen*" (late) were recommended for district plantings. Budwood of these strains were released to nurserymen.

Field comparison plots providing commercial conditions for the three Queen strains "*Yanco Queen*", "*Johnson Queen*" (early) and "*Taylor Queen*", and the early introduced variety Dix 6-6, were established in the district.

Twelve apricot selections added to the collection at Yanco increased to forty or more the total of strains under observation. Sixteen of these are in a variety trial planted in 1962. Canned samples with excellent quality have been produced from two selections; a Trevatt seedling from Yanco (YA54-13), and a Victorian-bred selection (VBS 21-19). Cropping data are as yet not sufficient for reliable assessment of their field potential.

Dessert Peaches.—Additional information was gained on the varieties under test at Bathurst and Narara, and good quality specimens were displayed at Hawkesbury Agricultural College and Bathurst field days. Winter-chilling requirements of all varieties have been examined, and an article has been prepared for publication.

Growers are keenly interested, and some of the varieties are now being planted commercially. Starking Delicious and Fragar have been accepted for commercial coastal production. Considerable areas of Redhaven are being planted on the tablelands.

Observation plots of all varieties under test are now established at Hawkesbury Agricultural College and in district plots at Arcadia, Glenorie, Menangle and Bilpin; to provide data on their adaptability and potential in diverse conditions.

Nectarines.—The Nectar series of yellow fleshed varieties recently introduced from America have been satisfactorily established in a trial at Bathurst. More trees have been propagated, for district plots; to observe their adaptability in a range of commercial conditions. Buds of the varieties were released to growers wishing to test the strains.

Plums.—Propagation material from all known plum varieties in the State were collected, for inclusion as trees in the plum variety collection at Bathurst.

With better understanding of cultural needs, and increased demand for plums following improvements in packaging for market, interest in varieties not profitably produced and marketed in the past is developing. Varieties not widely grown commercially will be re-examined for current suitability.

Cherries.—Observations on performance of cherry varieties in district plots at Orange, Young and Lakesland continued. Of the new varieties being tested, Regina (bred by the Department) and Merton Heart have done well at Young and should find a place in district plantings. Other new varieties under test show no advantage over existing varieties at Young, but Ransom and Regent (both Departmentally bred) show promise at Orange.

Trees for a cherry variety collection on the Agricultural Research Station, Orange, have been propagated. The collection will include the introduced varieties Sam, Deacon, Lambert and Van. These have not yet been tested in orchard plantings in N.S.W.

Clonal Strain Selection-Peaches

This year a collection of propagation material from trees with outstanding performance characteristics was started. Trees of five strains of the main dessert peach variety J. H. Hale, and nine strains of the main canning variety Golden Queen, have been propagated for trial plantings.

Stone Fruit Rootstocks

Rootstock trials with peaches, prunes, plums, cherries and apricots continued to provide valued information.

Use of plum rootstocks for peaches and apricots is receiving special attention. In a trial planted at Bathurst in 1965, peach trees on various plum stocks are less vigorous than trees on peach seedlings. Brompton plum as a rootstock has produced better trees than other plum stocks used, but cropping data are lacking as yet.

A trial to compare apricot seedlings and Buck plum as rootstocks for apricots under irrigation area conditions was planted at Yanco Station, and district plots were established.

Interaction between rootstocks and virus infection in cherries is being studied at the Agricultural Research Station, Orange. Other trials in the Orange district continue to demonstrate resistance of F12-1 seedling rootstock to bacterial canker infection.

Peach Nutrition

Anhydrous ammonia and calcium ammonium nitrate have been compared as source of nitrogen for Golden Queen peaches over the past four years at Yanco. There has been no significant difference in yields. Difficulties associated with land preparation for the use of anhydrous ammonia off-set any savings in the cost of materials. Growers have not been interested to use this fertilizer. The trial has been discontinued. Results have been published in the I.R.E.C. Newsletter.

Results of peach leaf analysis studies in the M.I.A., in association with the Chemistry Branch, have helped establish a useful basis for general fertilizer recommendations. But whether a leaf analysis service to individual growers would be of sufficient value is doubted.

Deciduous Fruit Tree Improvement

Inspection of parent trees to be used by nurserymen as a source of budwood has assured less risk of virus in trees produced for commercial plantings.

In the M.I.A., following the previous season's detection of virus conditions in peaches, a complete survey of peach plantings was undertaken this spring. This revealed virus symptoms widely distributed throughout the district, in all varieties. A continuing examination of the conditions observed and collection of samples for pathological investigations are proceeding in co-operation with the Biology Branch.

Control of Post-Harvest Rots

Thiabendazole effectiveness against brown rot (*Sclerotinia fructicola*) was confirmed, and compared with the chemical 1991 (now named benomyl and being developed under the trade name benlate) on peaches, apricots and cherries. Better control of brown rot was given by benomyl, but neither was effective for control of *Rhizopus* rot. Two new substances (termsalt T.D. 5056 and daconil 2787) were less effective for control of brown rot, but gave better control of *Rhizopus*.

A paper on the effectiveness of thiabendazole was published. As with benomyl, tests on a commercial basis and recommendations for commercial use on stone fruits await clearance by Health authorities.

Apricot Breakdown in Cans

This troublesome problem has been investigated over a number of years, without securing control or prevention of the condition. This year Divisional officers co-operated with the CSIRO, the Leeton Co-operative Cannery and the Golden Circle Cannery to test the theory that *Rhizopus* infections are contributing. Preliminary data indicate relationship between breakdown in the canned fruit and pre-canning exposure to *Rhizopus nigricans*.

RESEARCH—STRAWBERRY INDUSTRY

The breeding programme continued at Narara. Eighteen selections were made from seedlings raised from crosses made in 1968. Testing of five 1968 selections and two 1967 selections will continue. A 1967 selection (N. 67-5) is highly promising. All of the 1965 and 1966 selections have been discarded. They were less suitable than existing varieties.

The most promising 1967 and 1968 selections are being tested at Hawkesbury Agricultural College; the selection N. 67-5 has also been planted in district plots and included in a trial at Bathurst.

A variety trial has been established at the Bathurst Station to test for tableland conditions all promising available varieties.

TILE DRAINAGE RESEARCH

Agronomic responses of oranges, grapes, peaches and prunes to various depths and spacings of tile drains are being studied at the Griffith Viticultural Research Station.

Critical water tables (complete soil saturation) were induced for a period of 24 hours at the end of September, 1968. No adverse response to these conditions was noted in the test trees, even under the drainage treatments that fail to satisfy the criteria adopted for commercial tile drainage installations in the MIA.

The trial was again deliberately saturated, for a period of 48 hours, in April, 1969, but subsequent heavy rain prolonged the period of saturation. By winter 1969 no adverse response from any of the fruit crops had been observed, other than in peaches a slightly earlier defoliation which appeared to be independent of the drainage treatment. But final responses to this April inundation and the abnormally high 1969 winter rainfall may not be obvious before the 1969-70 growing season.

THE RESEARCH STATIONS AND LABORATORIES AFFECTING FRUIT INDUSTRY

Alstonville Tropical Fruit Research Station

Contracts were let for office and laboratory extensions. A controlled environment chamber is now in operation. Extensions to the irrigation mains now enable irrigation for the papaw, mango and macadamia blocks.

Banana multiplication plantings have been extended, for future planting material. Small plantings made of pineapples and Fuerte avocado have been made, for short-term experiments.

Bathurst Agricultural Research Station

Nectarine and strawberry variety trials were planted. A soil management trial of herbicides in stone fruit was started. A controlled temperature room was constructed, for stone fruit post-harvest studies. Propagation of hardwood apple cuttings is being investigated, following construction of specially prepared beds mentioned earlier. A tablelands pome and stone fruit extension/research liaison conference was held at the Station in March.

Horticultural Research Station, Dareton

A planting of 1,554 Valencia orange trees was made, for citrus nutrition work. *Inter alia* the planting is double-planted in the tree row and includes two rootstocks, Troyer citrange and sweet orange. The trial will investigate 64 combinations of nitrogen, phosphate and potassium, under two soil management programmes. All fertilizer plots are fully buffered.

Commercial lemon and mandarin varieties were included in the Citrus Parent Tree Block started in 1967. Initial plantings—Navel, Valencia and grapefruit selections—have progressed well. The parent tree plantings are on behalf of the N.S.W. Citrus Bud Selection Society. The Society will control budwood distribution to nurserymen. This planting should meet the certified budwood needs of all nurserymen in N.S.W.

A second fruit research officer was appointed. A more substantial viticultural research programme will be one outcome.

Irrigation of the double-planting trial was converted from a permanent overhead to a movable under-tree sprinkler system. New equipment included an oscillating boom sprayer and a herbicide boom.

Gosford Citrus Wastage Research Laboratory

Co-operative investigations with the CSIRO Division of Food preservation, on fruit handling and decay control in citrus fruit, and disinfestation of bananas against Queensland fruit fly, continued.

New projects included preliminary examination of the application of controlled atmosphere storage to Marsh grapefruit and Eureka lemons. A small unit of transverse brushes was added to the citrus washing and waxing equipment, for detailed investigation of problems in applying thiabendazole to washed fruit.

Griffith Viticultural Research Station

Installations comprised 10 chains of 12 inch water pipeline to facilitate irrigation of research plantings, a pressurised domestic water supply system, and glasshouse heating and cooling equipment. A root-observation chamber was completed, for studies of grape root-growths under varying soil moisture regimes.

Horticultural Research Station, Narara

A soil fumigation trial for nematode control has been superimposed on a Valencia rootstock trial, before re-planting a lemon rootstock trial in 1971.

A planting of Valencia oranges on trifoliata stock was made for the Citrus Improvement Committee, to investigate possible pathogenicity of the "sudden death" disease occurring sometimes in mature citrus on trifoliata rootstock.

North Ryde Fruit Preservation Research Laboratory

Storage investigations were continued in co-operation with the CSIRO Division of Food Preservation. New projects included the design and construction of a plastic "tent" and external generator, for research purposes mentioned earlier; the study of the effect of weight loss on low temperature injury in Starking Delicious peaches; and the trial of long distance transport and storage of bananas in polyethylene film—following the previous year's promising laboratory results.

Orange Agricultural Research Station

Several new pome fruit plantings are being made at this new Station, including a tree-training trial and a variety and seedling collection. Further, suitable horticultural land is limited. Projected future pome and stone fruit plantings may be accommodated on the Orange Agricultural College site. Land there suitable for fruit has been selected.

Yanco Agricultural College and Research Station

An apricot rootstock trial was planted. Additions were made to the peach and apricot variety trials.

Research and extension officers of the Division met here in May, 1969, to discuss results of research and also industry needs for citrus, stone fruits (canning) and grapes—especially in relation to irrigation conditions.

Hawkesbury Agricultural College

Pome, stone, citrus, nut and vine plantings were maintained for teaching purposes. A recent peach-collection planting will provide information supplementary to that from trials planted at Bathurst Agricultural Research Station planting and in various districts. The newly introduced series of yellow-fleshed nectarines were added to the collection. Testing of promising selections from strawberry breeding at Narara continued.

Wagga Agricultural College

Renovation of the packing-house was started. A new sizing and grading unit was delivered; also other items, including an orchard land grader, vine hoe, under-tree cultivator, bulk bin trainer and bulk bins. The new equipment and modernizing of the packing-house will enhance the teaching functions. Pome, stone, citrus, nut and vine plantings were maintained for this purpose.

COMMITTEES AFFECTING RESEARCH

Co-ordination of Fruit and Vegetable Processing Research

The Committee comprises representatives from the CSIRO, N.S.W. Department of Agriculture, the University of N.S.W. and the canning industry. A sub-committee meeting, on breakdown of apricots in cans, formulated plans to examine the possibility that *Rhizopus nigricans* contributes to the problem. Trials of this were conducted. Results will be known when the canned samples are opened for a storage period.

Co-ordination of Fruit and Vegetable Storage

The biennial meeting of this Committee was in Hobart in August, 1968. Representatives from the Department of Primary Industry, the CSIRO, all State Departments of Agriculture and New Zealand attended. The Committee considered storage problems of pome, citrus and tropical fruit in particular, and objective methods to assess fruit maturity.

Recommendations from the meeting included: need in all States for appointment of extension officers to specialize in advice on storage, transport and handling of fruit and vegetables; need of designs and specifications for model cool stores for fruit and vegetables; and the desirability of a fresh survey of performance of cool stores for fruit and vegetables.



Parent Trees for Citrus, Certified Bud Wood

At Dareton Horticultural Research Station a Parent Trees Block (orange, grapefruit, lemon and mandarin varieties) has been established. This will be the N.S.W. Co-operative Citrus Bud Selection Society's source of certified bud wood for nurserymen throughout N.S.W.

Murray Citrus Sub-Committee.—This sub-committee of the Co-ordination Committee for Fruit and Vegetable Storage Research met at the CSIRO Irrigation Research Laboratories, Griffith, in October, 1968. Then district citrus packing-houses and citrus research institutions were inspected. The N.S.W., Victorian, and South Australian Departments of Agriculture, and the CSIRO Division of Food Preservation are represented in the sub-committee. They annually review post-harvest storage of citrus, and related research. The wide range of topics considered at Griffith in October included: fruit injury during and after harvest; fungicide treatments, especially the promising new fungicides thiabendazole and benomyl, and related fruit residues; and controlled atmosphere storage of citrus.

Pesticides Residues in Plants and Plant Products

This is a sub-committee of the intra-Departmental Pesticides Policy Committee, set up to review the pesticide residue situation in respect to plants and plant products. It recommends priorities in residue research where insufficient information is available.

High in the list of priorities recommended are investigations into residues associated with post-harvest treatments of fruit, including the chemicals TBZ, benomyl, 2-AB and dimethoate. These materials are of particular interest in respect to post-harvest control of rots and fruit fly disinfestation.

A working body, with representation from the Divisions of Science Services, Plant Industry and Horticulture has drawn up details of investigations to provide the needed residue data, and to integrate this work with the biological, horticultural and entomological investigations of the respective Division.

Apple and Pear Spray Residues

The Apple and Pear Spray Residue Committee this year held its final meeting. It was set up under the authority of the Department of Primary Industry to investigate and if necessary evolve methods to remove toxic residues from export pome fruit. The Committee employed a full-time analytical chemist and assistant in the Chemistry Branch, Division of Science Services. Large numbers of fruit samples have been analysed for levels of various spray residues.

The Committee's work in this way was valuable service, relating primarily to the significance of residues for fruit shipped overseas, but also to fruit marketed within N.S.W.

The results of the Committee's work clearly demonstrated that recommended spray schedules did not of themselves result in excessive fruit residues. For N.S.W., the "Intra-Departmental Pesticide Residues in Plants and Plant Products Committee" now has the responsibility of ensuring that recommended spray programmes do not result in excessive residues.

Fresh Fruits Disinfestation

This Committee, currently concerned with the sterilization of bananas against Queensland fruit fly, comprises representatives of the Commonwealth Department of Primary Industry, the CSIRO, and the State Departments of Agriculture of N.S.W., Queensland, Victoria and South Australia. Finance for the current 3-year programme of research is provided by these bodies and the Australian Banana Growers' Council. The investigations are centred at the Citrus Wastage Research Laboratory, Gosford.

Central Coast Agricultural Research and Extension (C.C.A.R.E.C.)

The objective of the industry-sponsored C.C.A.R.E.C. is to assist co-ordination of agricultural research and extension in the Gosford/Wyong districts. Besides organizing field days and demonstrations, and the consideration of grower-problems by sub-committees, the Committee instigated appointment of the research officer now studying citrus rind blemish—and the Committee has agreed to contribute substantially towards equipment for the investigations.

M.I.A. Irrigation Research and Extension (I.R.E.C.)

The industry-sponsored I.R.E.C. continues to review research and extension needs in the M.I.A. It deals with most fruit-growing matters through a Horticultural Sub-Committee. The usual census of fruit tree plantings was undertaken and the Committee rendered valuable assistance to the Department in the peach virus survey—including appropriate publicity.

Viticultural Sub-Committee to I.R.E.C.—The inaugural meeting of the Viticultural Sub-Committee was held at Griffith in June, 1969. It is to enlist industry guidance and support for the research programme of the Viticultural Research Station, Griffith, and function also as a centre for information exchange.

Banana Research Advisory Committee

The Committee meets annually and comprises representatives of the Commonwealth Department of Primary Industry, the State Departments of Queensland and N.S.W., the Australian Banana Growers' Council and the CSIRO. It reviews the post-harvest banana research programme undertaken at Alstonville Tropical Fruit Research Station, the Hamilton Research Laboratories of the Queensland Department of Primary Industries, and the CSIRO Division of Food Preservation, North Ryde. A conference of investigators in the post-harvest field was again sponsored by the Committee and very useful discussions resulted.

Recommendations from a technical sub-committee were considered at the 1969 annual meeting. It was agreed that investigations be continued into pre-cooling, handling and packaging, the mixed ripe problem, ripening, and market diseases.

Banana Containers Committee

Investigations into size, type and packing patterns for N.S.W. containers are directed by the Banana Containers Committee comprising representatives from the N.S.W. Banana Industry and the Division of Horticulture. Largely due to the Committee's work, a standard carton size (net 35 lb weight of packed bananas in hands) has been accepted by the industry in N.S.W. and Queensland.

Banana Beetle Borer Control Committee

This Committee comprises representatives of the Banana Diseases Control and Development Co-operative Ltd and the N.S.W. Department of Agriculture, with finance provided by the Co-operative. Currently the Committee is directing a programme to contain and control banana beetle borer in the southern banana areas and, if possible, eradicate the pest.

Banana Processing Committee

The industry Committee wherein the Department is represented examines the potential of banana by-products and processing, for disposal of banana surplus in times of over-production.

Citrus Improvement

This Departmental committee comprises senior officers of the Division of Horticulture and the Biology Branch of Division of Science Services. The two meetings this year discussed research projects which have been designed to gain a full appreciation of the various virus complexes affecting citrus and, with this knowledge, to improve budlines and rootstocks for commercial use. One development in recent years has been the differentiation of dwarf budlines from the Exocortis stunting virus.

The Committee reviewed projects under its control. It initiated a new trial, to attempt to establish pathogenicity of the sudden death condition; recommended propagation at the Horticultural Research Station, Narara, to establish both scion and rootstock trials for Ellendale mandarine; a lemon rootstock trial on old citrus land; a late navel rootstock trial; and further propagations for the proposed Cudgel citrus demonstration orchard.

Yet another current project of the Committee concerns the screening of a wide range of locally bred citrange rootstocks for *Phytophthora* and lime and salt tolerance.

N.S.W. Citrus Bud Selection Society Ltd

The Committee of this Society (a non-profit organization that has operated successfully for 40 years in the collection and distribution of selected budwood to nurserymen) provides representation from nurserymen, citrus growers and the Department. The Department has commenced at the Horticultural Research Station, Dareton, a parent tree planting embracing all commercial varieties—to provide from the one source all budwood required by the Society.

Objections to the cutting of budwood, following sale of private orchards whereon registered blocks of trees had been available, led to acute shortage of certified material for propagation. This prompted the Dareton planting.

Citrus Wastage Research Committee

The Committee met twice this year at the Citrus Wastage Research Laboratory, Gosford, to review progress of current research programmes and other laboratory activities. It comprises representatives from the Department of Agriculture and the CSIRO Division of Food Preservation.

Besides reviewing progress of investigations and approving of a 1969-70 research programme, the Committee recorded satisfaction in the granting of approval by health authorities for use of thiabendazole (TBZ) in post-harvest treatment of citrus—and a tolerance established.

Subsequently, the Laboratory staff presented data to the citrus industry of Australia and made a provisional recommendation for the use of TBZ in the marketing of citrus in N.S.W. Recommendations along similar lines were made to other States and to the Commonwealth to obtain clearances from export markets.

Citrus Nutrition Committee

This comprises members from the Division of Horticulture and the Chemistry Branch, Division of Science Services. They met with District horticultural officers to review the year's final data on citrus leaf analysis from the various Districts in the 5-year survey of the State.

The Committee has recommended a programme for computerisation of this data, and will meet again soon to discuss all possible avenues for extension of the data—by way of research papers, Gazette articles, and District extension programmes.

Deciduous Fruit Tree Improvement Committee

Comprising officers of the Division of Horticulture and the Biology Branch, Division of Science Services, this Committee aims to prevent spread of virus diseases—by selecting suitable propagating material and making the selections available to nurserymen.

The virus position with canning peaches in the M.I.A. received special attention this year, with the complete survey of peach plantings there.

Canning Fruits Committee

The N.S.W. section of the Australian Canning Fruits Advisory Committee met in August, 1968, and March, 1969. Uncertainties in the marketing situation and the possible outcome of current negotiations to stabilize the industry made it difficult for the Committee to formulate a firm planting policy for canning fruits in the M.I.A.

Examination of trends revealed a decline in bearing areas of both apricots and peaches, and likely accentuation by increased tree removals and reduced planting rates. A Committee recommendation emphasised the importance of maintaining production at present levels until future prospects may be more clear, and the need to increase the planting rate to offset effects of increased removals.

Vine Improvement Research Committee

Comprising representatives from State Departments, the CSIRO, the Australian Wine Research Institute and the wine and dried vine fruit industries, the Committee examined progress of vine research in the past year; the use of rootstocks; clonal selection; variety introduction; vine virology; phenological data; mechanical harvesting, and associated trellis design modifications.

It was pleased to note the considerable progress in variety introduction and clonal selection of wine and drying varieties. A sub-committee was formed to establish a central index to record all vine introductions, as well as clones selected in Australia.

Extension Services to Fruit Industries

GENERAL

Programme Planning

Considerable progress was effected in respect of extension programme planning.

A detailed examination of the structure and "needs" of each fruit officer District led to sub-division of the Orange District and the Gosford District—each into two. Thus there

are now twenty-one "Districts": Armidale, Barham, Bathurst, Campbelltown, Coffs Harbour, Dareton (2), Gosford, Griffith (2), Leeton (2), Lismore, Maitland, Mullumbimby, Murwillumbah, Orange, Parramatta, Tumut, Windsor and Young.

"Situation analyses" were done in each District as the basis of each officer's extension programme. Efforts were made to co-ordinate programmes; towards a degree of uniformity throughout the State, and to focus on industry problems of major importance. At the same time, care was taken to avoid unnecessary restriction of individual officer initiative.

A current problem of Division of Horticulture with respect to programme planning is that of the twenty-one fruit officer Districts only four are staffed by officers who have been there for three or more years. This directly reflects the high proportion of young officers in the extension establishment.

Staff Training

Extension Training.—Action was taken to expedite training, by interchanging young officers and attaching them to appropriate District headquarters to assist surveys and other special projects. Also, a school for Divisional extension officers was held at Hawkesbury Agricultural College in August, 1968. This dealt with administrative procedures and technical aspects of horticultural extension common to all fruit disciplines.

Packing Classes.—Fruit packing and other post-harvest handling and marketing matters were subject to classes conducted at the Agricultural Research Station, Bathurst, and the Yanco Agricultural College and Research Station. The classes were for young fruit officers and inspectors (P.D. Act). More classes have been programmed for the coming year, as refresher courses and for advanced training.

Biology School.—District officers attended also a Biology School at Rydalmere, designed to meet field officers' interest in Biology Branch functions and to enhance their understanding of biological problems encountered in their district work.

Processing of Fruit Planting Statistics.—Extension officers from throughout the State attended a conference at head office in February concerning new procedures arising from the proposed automatic data processing of the Division of Horticulture's 1969-70 fruit planting statistics.

Extension/Research Liaison

Successful regional extension/research liaison conferences were held at Lismore (tropical fruits), Bathurst (pome and stone fruits) and Yanco (citrus, stone fruits and grapes). Officers, with similar interests were brought together to raise and discuss problems and get to know more about the extension and research activities of colleagues. Each conference gave the District officers the chance to examine the various trials at the particular Research Stations and gave the Division's research workers the chance to discuss at first hand the field problems confronting extension officers.

Planting Statistics—Use of A.D.P. and Aerial Photography

The Division's collection and publication of detailed planting statistics for horticultural crops in N.S.W. provide the basis for planned development of the respective fruit industry. In 1969, Automatic Data Processing (A.D.P.) will for the first time be used to process the census figures.

Following exploratory studies by the A.D.P. Systems Officer, record cards and data sheets have been prepared. District fruit officers have been briefed in the new system. Besides time-saving effect and probable higher accuracy, the use of A.D.P. will extract more information from the planting statistics.

Also, starting with the 1969 planting census, arrangements are in hand with the Department of Lands for aerial photography of each of the major fruit growing Districts—to help ensure that all variations to plantings are recorded.

Assistance to Various Authorities

Assistance to various Government and Local Government authorities continued. Particular instances were the evaluation of alleged damage to horticultural plantings from Postmaster General's Department and/or Electricity Commission constructional work and maintenance programmes. Technical assistance was also provided to the Closer Settlement Advisory Board in its administration and development of land settlement schemes.

EXTENSION ACTIVITIES OF SPECIAL INTEREST

Herbicide Management of Citrus

Activities to encourage adoption of herbicide-management as a cultural technique for citrus production have been very successful. Herbicides have been shown to be an effective alternative to cultivation for control of under-tree weeds and as a total "blanket treatment". It effects a substantial saving in labour costs, compared with conventional cultivation. The importance of this is underlined by the estimate that labour comprises 30 per cent of farm costs.

Growers were encouraged to take on herbicide-management slowly, to adapt it to local situations and to choose the best herbicide for the soil types and weed populations concerned.

Citrus Irrigation Practices

Under-tree irrigation by means of drag hose was extended in coastal districts because of its advantages for supplementary irrigation where water limitation demands maximum utilization. The system also has the advantage of initial low capital outlay.

Field days on the central coast and at Hawkesbury Agricultural College compared the drag line system with conventional sprinkler methods of irrigation. The advantages in water distribution, and low capital and running costs, were featured there.

In the Murray River districts some growers have already started to convert from overhead systems to achieve better water distribution, although the pressing urgency to do this to avoid foliar absorption of chloride disappeared when river water quality improved.

Considerable recent interest has been in "trickle" or "drip" irrigation whereby water is led to trees by laterals of polythene piping and capillary tubing—or tricklers are fitted to allow very slow application. In fact, adoption looks likely to outpace research in trickle irrigation—but extension officers are being kept informed of developments enabling them to discuss informedly with growers the principles of the system.

Red Scale Control—Murray and M.I.A. Areas

Red Scale was a major problem in the Murray and the Murrumbidgee areas last season. Extension programmes for each area aimed at achieving greater awareness of need of a thorough, correctly timed spray programme.

Fruit officers and inspectors actively published control measures by press, radio and television, and at citrus field days. As a result, Red Scale control spraying was widespread and more timely and thorough. There were, however, still timeliness difficulties in the M.I.A. areas because the harvesting of canning peaches coincided with the best time to spray for Red Scale control.

The fruit officer at Dareton co-operated with the Plant Research Laboratory at Irymple to release Red Scale parasites (*Aphytis lignanensis* and *A. melinus*) in selected N.S.W. citrus groves. Biological control has played an important role in some of the Lower Murray districts and these releases could increase the benefit—perhaps to the extent of eliminating need of organophosphates in the spray control schedule.

Citrus Leaf Analysis and Nutrition Survey

Leaf-samplings were completed in the five-year programme conducted on 150 citrus orchards in the State's major citrus areas. The big volume of data collected has been reviewed by the Citrus Nutrition Committee before submitting the final detail of analysis, fertilizer practice, production, etc., to computer analysis.

The survey results should lead to more accurate standards of nutrient deficiency levels, enable better interpretation of leaf analysis as a guide to fertilizer practice, and give District officers better background information for formulating local recommendations on citrus nutrition.

Post-Harvest Wastage Control in Citrus

Considerable extension effort was directed to citrus post-harvest handling. At a field day at Griffith and in a school at Mildura conducted co-operatively by the Victorian and N.S.W. Departments of Agriculture, officers from the Citrus Wastage Research Laboratory, the CSIRO and from head office actively participated. The Victorian Department pre-

pared a booklet of all papers presented at the Mildura school and this up-to-date reference on post-harvest handling has been distributed to all extension officers in citrus districts.

Because of world shortage of SOPP, and because thiabendazole (TBZ) is as effective in mould control and does not present rind injury problems, an acceptable method of applying TBZ as an alternative fungicide to SOPP has been extended to the industry. A further issue of the "Newsletter on Developments in Post-Harvest Handling" was made from the Citrus Wastage Research Laboratory, for extension officers in citrus districts and interstate distribution.

School on Storage of Apples and Pears

Controlled atmosphere (CA) storage of apples and pears was subject of a highly successful extension school at Orange, jointly organized by the CSIRO Division of Food Preservation and the Department. About 300 people attended, with representation from every State. The big attendance confirmed the demand for technical information on CA storage. CA correctly managed ensures availability of high quality pome fruits for the twelve months of the year.

Field Days for Stone Fruits and Strawberries

Two major field days featured stone fruit varietal improvement work and orchard management practice; one at Hawkesbury Agricultural College and one at the Agricultural Research Station, Bathurst. Attendance was 130 and 230 growers respectively. The recently introduced peach varieties drew great interest. At the Hawkesbury College field day the under-tree irrigation systems and the use of herbicides also were demonstrated. At Bathurst all of the field trials were inspected and discussed.

The rapidly developing strawberry industry was catered a field day attended by 200, at the Horticultural Research Station, Narara. The Station's variety breeding and selection work were featured, as were talks on disease control and cultural management.

Pest and Disease Control in Stone Fruits

Advice on control and the timely warnings on pest and disease incidences continued important in the field extension work. Close watch was maintained in all districts for early signs of insect infestations and likely disease outbreak effects of seasonal conditions.

This year special attention had to be paid to control of thrips—particularly in strawberries, and control of Rutherglen bug in all crops. Brown rot needed special attention in the M.I.A. due to moist conditions during harvesting. Orchard sanitation was emphasized, as usual, for control of all diseases—especially brown rot.

Peach Pruning Classes and Demonstrations

Pruning classes were conducted in the M.I.A. to help overcome shortage of skilled pruners there. Use of the long-lateral system on peaches was demonstrated, and pruning demonstration blocks have been established at Leeton and Griffith to show the management needed where trees are pruned to this system. Demonstrations of conventional pruning were conducted in other districts.

Banana Packing, Presentation and Marketing

Programmes of the various committees concerned with aspects of banana handling and marketing, and particularly the work at Alstonville under the aegis of the Banana Research Advisory Committee, have underlined the need for more care in handling, packing, presentation and marketing. North coast extension worker programmes have pressed these matters. *Inter alia*, a well-accepted field day at Coff's Harbour concentrated on improved packing shed design and handling.

Banana Post-Harvest Diseases Control

District fruit officers are advising banana growers on use of thiabendazole (TBZ) in lieu of salicylanilide as post-harvest fungicide. Research by the Division had shown that TBZ controls both squitter and black-end whereas salicylanilide is ineffective against black-end. TBZ has been approved for bananas by the Health authorities and there is provisional approval for use at 200 ppm.

Banana Beetle Borer Control Campaign

In the southern banana areas, containment and control of banana beetle borer by systematic inspections and treatment of infestations are being campaigned. Publicity and grower-education in recognition of the insect and the symptoms are the components. Recognition has been visually aided by television and field day demonstrations, and a high level of grower awareness of the threat has been achieved.

Viticultural Field Day and Vine Irrigation

A comprehensive field day at the Viticultural Research Station, Griffith, in January dealt with clonal selection, use of herbicides in vineyards, and vineyard irrigation.

The Station's irrigation research was highlighted by demonstration of a new method to determine when irrigation is needed; measuring the water status within the vine, instead of the conventional relating of the soil's moisture content to the vine's water needs.

Selected Sultana Clones and Nematode Resistant Rootstocks

District officers supervised the planting of about 95 acres of selected, high-performance sultana clones in the Lower Murray District and recorded the location of each planting—to be a source of cuttings for future plantings. By this means there will be by 1970 sufficient selected clonal material for all new plantings.

Use of nematode resistant stocks for drying grapes has been programmed for a start, on commercial scale, in the Lower Murray District where nematodes and saline soils are a problem. Rate of distribution of these stocks depends on supply of cuttings obtainable only from non-bearing rootstock mother-vines.

Table Grape Maturity Testing Service

Continued efforts by fruit officers and inspectors and the improved, grape-maturity testing services have in general raised the quality of table grapes offered for sale. This year, markedly fewer consignments had to be seized at the Sydney Municipal Markets because of immaturity. They totalled only fifty-one, and many of these were merely trial consignments of one or two cases.

Wine Industry Expansion Assisted

Continually increasing demand for wines in Australia, the resultant shortage of wine and wine grapes, the declining returns from other agricultural enterprises, and the increased land values, have further stimulated interest in wine grape growing. This interest has brought heavy demand on advice from officers of the Division, on suitability of various regions and soils in N.S.W. and the feasibility of wine industry in these areas.

Surveys were made of Cowra, Coonabarabran, Narromine, Mulgoa and Cummock districts for the purpose. In addition, growers new to established wine grape districts were helped to choose suitable sites and establish a vineyard.

In the new areas surveyed, development has been delayed by need to provide processing outlets. Even so, officers have been involved in two large projects—each involving over 500 acres of new vineyards. They were also involved in several smaller developments, in the Hunter Valley, and in proposals developing within the Irrigation Areas. In the latter, substantial areas of other fruit crops are being replanted with wine grapes.

Fruit Packing and Market Presentation

Field Days and Demonstrations.—Twenty-two field days throughout the State featured fruit packing and market presentation. At these the Fruit Packing Instructor by means of talks, displays and demonstrations advised growers on correct preparation of fruit for market.

The National Field Days at Orange, where 2,500 persons attended the orchard section, highlighted these activities. Here the packing methods for all fruits in season at the time were demonstrated and displayed. Emphasis was placed on tray-pack cartons for pome fruits. Other major gatherings included Macksville (tomatoes), Narara (strawberries), Bathurst (stone fruits), Coffs Harbour (bananas)—with their attendances ranging from 100–250 growers.

Evaluation of New Containers.—Evaluation of new types of container and packing material for fruit was an important Divisional activity. The Fruit Packing Instructor was heavily

involved. *Inter alia*, long-distance transport trials of fruit from N.S.W. to other States were organised and, on the other hand, the outturn of fruit in experimental containers—apples from Tasmania and pineapples from Queensland—was evaluated at the Sydney markets.

Press Articles and Publications.—Fifteen articles by the Fruit Packing Instructor, on fruit presentation and marketing, were published by the rural and metropolitan newspapers and some also by various trade journals. A new extension bulletin "Packing Bananas for Market" was prepared, and published firstly in the Agricultural Gazette.

Propagation of Clonal Apple Rootstocks

The Division is providing a needed service to the apple industry by supplying—to commercial nurserymen—propagatory material of rootstocks that will be strongly sought in future years.

Seedling rootstocks have been used very extensively in the past 20 years. But apple growers are now specially interested in vegetatively-propagated clonal rootstocks that develop smaller and earlier cropping trees. To enable nurserymen to establish nucleus mother-beds they have been supplied with 400 selected rootstocks from Departmental nurseries. Further quantities have been programmed to be available next year.

Nurserymen have been instructed in the needed different methods to propagate this material, as against raising seedling rootstocks. The Annual Orchard Field Day at Bathurst Agricultural Research Station emphasized the types of rootstocks under reference and the methods for their propagation.

Fruit Industry Trends

CITRUS INDUSTRY TRENDS

Seasonal Conditions and Developments

In N.S.W. coastal districts drought prevailed in the spring and summer. Frosts in late July, 1968, had caused considerable tree injury and crop losses on the lowlands at Richmond and in the Orangeville/Werombi districts. Subsequent dry conditions were extremely unfavourable for fruit setting and led to many light crops and the setting of secondary crops where adequate, supplementary irrigation was not possible.

As a result, the current coastal crops range from negligible to quite heavy (where adequate irrigation was possible during the drought). This drought had followed so soon the one in 1965 that many previously reliable water resources failed.

Inland irrigation districts' crops set during the 1968 spring were generally lighter than the previous season's record crop. Growing conditions in the inland irrigation areas were vastly improved by comparison with the previous year's drought and salinity problems. Good leaching rains and adequate flows through the river system dealt with the salinity. However, the high salinity in Murray districts in the previous year—coupled with the big crop carried—contributed to the expected 1969–70 fall in production.

Citrus Production

Final estimate for N.S.W. in 1968–69 was 6,710,000 bushels main crop, plus 120,000 bushels summer crop lemons and 110,000 bushels second crop Valencia; an overall 6,940,000 bushels. This estimate was some 520,000 bushels less than the 1967–68 production of 7,460,000—when over 1,000,000 bushels of Valencia were produced in the Gosford district.

The final estimate of main crop production for 1968–69 season and the preliminary estimate for 1969–70 season are compared in the following tabulations:

Production	1968-69 (Main crop)	1969-70
Navels	1,910,000	1,400,000
Valencias	3,640,000	3,080,000
Commons	36,000	36,000
Sevilles	14,000	14,000
Total Oranges	5,600,000	4,530,000
Lemons (winter crop)	430,000	560,000
Lemons (spring crop)	190,000	165,000
Mandarins	295,000	375,000
Grapefruit	195,000	210,000
Total Citrus	6,710,000	5,840,000
Plus 2nd Valencia crop	110,000	..
Summer lemon crop	120,000	..
	6,940,000	5,840,000

Citrus Processing

Increased Quantities.—There was even greater emphasis on processing in 1968–69 than in the previous season. Industry representatives have estimated that 38 per cent of N.S.W. production was utilized in this way. This trend is becoming similar to that in the U.S.A.—where most consumption of citrus has been through citrus juices and citrus based products.

Besides the trend with coastal fruit, the quantities processed in the M.I.A. and Murray districts rose sharply. In the M.I.A. 32 per cent of the citrus production total of 1,910,000 bushels was processed—including 36.5 per cent of the 1,485,000 bushels of Valencias. A 50 per cent increase in processing occurred on the Murray, where 906,000 bushels were processed in the Sunraysia area (about 65 per cent of this total came from N.S.W.). Also, the industry has estimated that 60 per cent of the State's lemon production was processed.

Tariff Board of Inquiry on Citrus Fruit Juicing.—The Principal Fruit Officer (Citrus) presented evidence on the activities of the N.S.W. Department of Agriculture relating to the citrus industry of N.S.W., at a Tariff Board of Inquiry on Citrus Fruit Juices in August, 1968. The Inquiry was instigated by the Citrus Growers Federation, towards increased duty on imported citrus juices—to protect the local industry. The evidence presented concerned the Department's interest in all aspects of the citrus industry, to help demonstrate that the industry is economically sound and adjusting to changing conditions.

Citrus Export

Citrus exported from the Port of Sydney totalled 88,600 bushels. A significant quantity of it came from Queensland as well as the M.I.A., but on the other hand much of the N.S.W. exports from the M.I.A. and all from the Murray districts were shipped through the Port of Melbourne. The final estimate of N.S.W. exports for 1968–69 is 220,000 bushels from Sunraysia and 49,400 bushels from the M.I.A.

Many of the navels exported from the Murray had a poor outturn in both Eastern and European markets. Rind injury was the major complaint. Substantial claims were made by importers. The bad outturn also had a restricting effect on Valencia sales in near Eastern markets.

A new market developed during the season was Holland, where near to 38,000 bushels were absorbed. Meantime, also, Hong Kong showed a steady increase in imports over the previous season's.

Citrus Packaging

The N.S.W. citrus industry has pressed hard to have the 4/5th bushel container gazetted as the only container for the marketing of citrus in this State. Originally, efforts were made to have the dimensions of the Californian carton gazetted as the 4/5th size. Now, however, there is some indecision. This is because the Sunraysia group have approval to export citrus in a 4/5ths, wire-bound container; a shallow version of the bushel Bruce box.

Citrus Marketing Organizations

The Lemon Marketing Board showed again its ability to control the marketing of lemons in N.S.W. and appears now to have the full support of growers and processors. Last season the Board prevented for a period the marketing of plain grade lemons and at the same time set and obtained a minimum price for the standard grade lemons.

The Gosford/Wyong Orange Marketing Board, continuing to organize its resources, made a market survey to determine ways to improve the image and sales of coastal citrus. As a result, this organization is likely to undertake a strong advertising campaign.

In the Victorian portion of Sunraysia the setting up of a marketing board has not been achieved, and in consequence the Board formed for the corresponding districts in N.S.W. has become quite inactive.

TROPICAL FRUIT INDUSTRY TRENDS

Banana Production

Severe drought and bushfire losses, following a year of exceptionally high production, reduced by comparison the total of fruit consigned through the Banana Growers Federation

Co-op. Ltd transport system. Consignments to all markets totalled some 3,531,091 packages (2,745,694 bushel cases packed in "singles" and 785,397 fibreboard cartons (7/10 bushel) packed in "hands"); some 3,295,471 bushels. With an estimated 300,000 bushels in direct sales to Brisbane, the M.I.A., Wollongong, Albury, Canberra, and other country order trade, the total N.S.W. 1968–69 production was some 3,595,471 bushels, or 1,244,709 bushels less than the record 1967–68 crop.

The 3,595,471 bushels production was from 22,696 acres, indicating a sharp fall in production per acre. The fall was partly due to the extended period of over-production from September, 1967, to May, 1968. This had so depressed the returns to growers that many of them "economized" on fertilizers and the disease and pest control programmes.

Banana Acreage and Planting Trends

Bananas in N.S.W. at 1st April, 1969, aggregated 22,696 acres; 834 acres less than a year earlier. New plantings totalled 687 acres, but destruction of 1,521 acres more than offset these.

Williams variety continued to dominate, with 20,471 acres. Dwarf Cavendish declined further, to 2,230 acres, about 9 per cent of the total.

Compared with the previous year, the total of commercial growers (one acre or more) decreased by 173 to 2,767. The total with less than one acre increased by 83 to 4,085, the highest ever.

Banana Containers

The banana industry in N.S.W. and Queensland has agreed to adopt a standard 35-lb net weight for fruit packed in cartons in hands. A carton 19 in x 14½ in x 8½ in has been tested and found suitable.

N.S.W. banana growers are seeking a wooden container for use to transport bananas in hands or clusters to the more distant markets. Many containers having net outturn weights of 43 lb to 50 lb have been tested for this purpose.

There is still an upward trend in use of fibreboard containers and about 23 per cent of the total packages consigned through the Banana Growers Federation this year were cartons.

New Markets and Products

The Japanese quarantine authorities have stated their requirements for fresh fruit entering Japan, and at present it is not possible to meet these in respect of Queensland fruit fly. Even if the restrictions were overcome, it is doubted that N.S.W. growers could compete on this market with such other producing countries as Taiwan and the Philippines.

The industry continued its investigations into the potential for processed banana products, and have enlisted assistance by the CSIRO Division of Food Preservation to examine technical aspects in detail. Several small private enterprises are now producing various processed products such as banana figs and powder, confections, and liquors.

Banana Industry Act

Towards more orderly marketing of bananas the Banana Industry Act was introduced at the request of the industry. Proposed Regulations of the Act require the Chief, Division of Horticulture to compile a list of persons eligible to vote in a poll to decide whether a Banana Marketing Control Committee shall be constituted to implement the new marketing proposals. This list of growers is now being compiled in anticipation.

Possible Aerial Control of Leaf Diseases

Sigatoka disease (leaf spot) and leaf speckle are active throughout the growing areas. Generally, little action is taken by growers, despite well-founded control recommendations by the Department. The difficulty of effort in fungicide application in the banana terrain is one reason.

This year 250–300 acres were sprayed from the air as a growers' demonstration in the Brunswick/Tweed area. Effect and cost of the aerial method, used very successfully overseas, will be studied. These could lead to more extensive use of fungicide in N.S.W. banana industry.

Production of Other Tropical Fruit

Acreage of avocados, passionfruit, and pineapples each increased slightly. Development of a large planting of macadamias in the Richmond River district has been projected.

Planting of grafted passionfruit hybrids in preference to seedlings has expanded, and per-acre yields have increased sharply because of the hybrid ability to crop over a longer period.

GRAPE INDUSTRY TRENDS

Wine Grape and Wine Production

Wine grapes production in N.S.W. for the 1969 vintage has been estimated as a record 52,000 tons, as against the record 49,536 tons for 1968.

In the M.I.A. (despite the unfavourable wet vintage period, and crop losses of 10–15 per cent) 43,210 tons of wine grapes were harvested, as against the previous record 41,669 tons in 1967. Tonnages of the major varieties were Semillon 8,106, White Shiraz 7,153, Black Shiraz 5,678, Doradillo 4,939, Grenache 3,255, Palomino 3,127, Pedro 1,814, and Gordo Blanco 1,783. Fruit quality was lower than usual, with the red varieties particularly deficient in colour. Reflecting the general shortage of wine grapes in Australia, M.I.A. winemakers introduced an additional 6,938 tons of Sultana, Gordo Blanco, and Waltham Cross from Murray River districts to augment local supplies.

The Hunter Valley vintage was conducted in good weather, but the cumulative effect of dry seasons and bushfires substantially reduced the crop. Production has been estimated as 1,500 tons, as against the 2,015 tons in 1967.

Wine production in N.S.W. for the 1969 vintage is expected to total 9,000,000 gallons, as against the 8,349,774 gallons in 1968.

Wine Grape Planting Trends

Increased consumption of both table and fortified wines has ensured a continued heavy demand for wine grapes, and interest in planting has remained high. Large holdings in the Hunter Valley have been taken up for wine grape growing. A near 5,000-ton capacity winery has been constructed on the Murray River at Buronga to cater for the district's new wine grape plantings. Capacity of many wineries in the M.I.A. has been further increased.

Planting and production data presented to the M.I.A. Wine Grape Planting Advisory Committee have shown that on present yields the 1971 production of true wine grape varieties in the M.I.A. could be 50,000 tons. The Committee decided "there still is a need for more grapes to be planted in the M.I.A., in particular Black Shiraz and Gordo Blanco and limited plantings of Grenache."

At the December, 1968, vine planting census in the M.I.A. the total area of wine grapes was 6,653 acres, including about 1,200 non-bearing acres. Net gain in plantings since 1967 was 681 acres. The increase in Leeton district alone was 156 acres, to a total of 305 acres.

In the Hunter Valley the acreage increased by 488 to 2,248 acres. And a further 600 acres seems likely to be planted in 1969.

Interest in the possibilities of Cowra, Coonabarabran, Mid Murray, Narromine, and Namoi Valley districts for wine grape plantings also is considerable.

Trends in Wine Grape Prices

In the M.I.A. there was a general increase in prices paid for wine grapes. Despite the lower quality of fruit processed, winemakers honoured their price agreement and paid the variety prices for all processed, e.g., Black Shiraz, \$75 per ton; Semillon, \$68 per ton; White Shiraz, \$55 per ton; Doradillo, \$49 per ton; and Grenache \$55 per ton. As in 1968, no adjustment was made for varying Baume readings.

In the Hunter Valley, prices remained at the high level of \$240–\$280 per ton.

Dried Vine Fruit Production

The latest estimate of Australian dried vine fruit production for 1969 is 50,659 tons, as against the 95,535 tons averaged for the previous 5 years. The N.S.W. crop is expected to approximate 7,800 tons. Seasonal conditions were most unfavourable.

About 400 acres in the N.S.W. portion of Sunraysia were damaged by frost in October, 1968, and hot windy weather during flowering hampered berry set. After the set, cool conditions retarded berry sizing and maturity. Then losses at harvest were heavy, because of 709 points of rain during February–March, 1969. Sultanas on lighter soil types, with maturity more advanced, were most affected. Poor drying conditions and a labour shortage accentuated growers' difficulties.

The N.S.W. Government has approved loans to assist dried vine fruit growers placed in necessitous circumstances by frost and rain damage to their crops.

The season's drastic low production, not only through the weather but through increasing diversion of sultanas to wineries and the fresh fruit market, has made difficult the supplying of current export markets. A quota system will be used in an effort to retain the goodwill of all markets.

Dried Vine Fruit Outlook

The International Sultana (Raisin) Agreement Conference in Athens, June, 1969, announced a \$15 per ton increase (to \$305 per ton) in minimum world prices. An emergency meeting of the Agreement participants affirmed that no transaction to result in prices below the Agreement levels would be entered into, and re-affirmed that the Agreement had been invaluable to growers, packers, exporters and buyers since it first came into effect in 1963.

The first Dried Vine Fruit Stabilisation Scheme ended with the 1968 season's crop. Negotiations for a second Scheme are proceeding and expected to be finalised shortly.

Dried vine fruit growers will receive an estimated \$416,000 to cover losses through devaluation effects in the United Kingdom and other markets.

Trend in Fruit Drying Methods

Sultana rack spraying to promote drying, introduced as an alternative to dipping, proved most successful this season. Adverse drying conditions encouraged growers to use the spray method. Faster drying rates, labour saving, and cleaner fruit were demonstrated.

Cold dipping of raisins was widely done in place of the normal boiling caustic dip. The rack spraying method also was used on raisins with fair results that may have been due partly to abnormally tender skins.

Another new system of sultana drying is being developed. This involves cutting the fruiting canes in March, spraying the fruit with dip solution and allowing it to dry on the vine. A darker fruit is obtained, but it dries evenly, is resistant to weather damage and is easily shaken from the vine. It makes mechanical harvesting of dried sultanas a distinct possibility.

Table Grape Industry

Prices for Sydney district Black Muscats returned to normal from last season's low, and also were excellent for the central tablelands' late season Black Muscats. Good returns have stimulated interest in further plantings in these districts, but any possible rapid expansion near Sydney has been limited by shortage of *Phylloxera*-resistant rootstocks.

Grape exports to overseas markets totalled 19,346 half bushels in 1968–69, as against 22,875 half bushels in the previous year. The quantity for export was limited by damaging, harvest rains.

POME FRUIT INDUSTRY TRENDS

Apple and Pear Production

The estimated N.S.W. 1968–69 crop of apples and of pears was each a record; 4,000,000 bushels of apples, compared with 3,423,000 bushels in 1966–67 and 3,000,000 bushels in 1967–68; and 678,000 bushels of pears, compared with 619,000 bushels in 1966–67 and 525,700 bushels in 1967–68.

Very dry conditions in the early coastal and coastal highlands districts until December, 1968, adversely affected size in early maturing varieties. Conditions on most parts of the tablelands were good for the entire season—except in parts of the New England which mostly were dry. Hail also caused damage in the New England, and in parts of the Batlow district. Fire damaged about 2,000 trees at Bilpin and a lesser number at Darkes Forest.

Pear production is not thought likely to increase significantly in the long term, but with 15 per cent of all apple trees under five years of age—and between 25 per cent and 30 per cent under ten years old—steadily expanding production of apples is anticipated.

Apple Prices

Prices for the part of the 1969 apple crop so far marketed have disatisfied many growers. Many Jonathans and Granny Smiths have been sold at a very unattractive level. There have been instances where final picking of Jonathans has not been made because of poor price prospects. Similarly, thousands of bushels of Granny Smiths (though mostly hail-marked) are still on the trees.

Cool Storage and the Effects of CA

In N.S.W. the cool store space now exceeds 3,000,000 bushels; 2,709,719 bushel space in atmosphere storage, and 295,500 bushel space in Controlled Atmosphere (CA) storage. Development of CA storage has been most positive following commercial adoption only three years ago.

The 1968 CA stored Delicious and Jonathan apples marketed in Sydney realised premiums of \$1.50 to \$2.00 per bushel and the Granny Smiths \$1.00 over and above the prices for ordinary-stored fruit. At this stage it seems probable that the marketing of CA fruit in Sydney in December and January of each year will make less attractive the production and marketing of early maturing apples. In this light, growers are not being encouraged to plant varieties maturing earlier than Red Gravenstein.

Apple Processing

Continued increase in apple production makes significant the proposed development of an apple cider plant at Campbelltown. It could be expected that at least ultimately the company concerned would process local fruit rather than import cider apple concentrate.

Elsewhere there are firm proposals for establishment of an apple-juicing plant. Also, several growers have installed crushing plants for juice manufacture, intended for direct roadside sales.

STONE FRUIT INDUSTRY TRENDS

Canning Fruit

The MIA canning-apricot harvest of 6,000 tons for 1968–69 was less than normal for an "on-crop" year, but about 1,400 tons more than the previous year's production. The crops there range, as between seasons, from 4,400 up to 9,400 tons.

The MIA canning-peach production was severely affected by losses through Rutherglen bug damage and brown rot. In early estimates about 20,000 tons was expected but ultimately the delivered tonnage at canneries totalled only 15,850 tons.

Handling and general management difficulties have dissatisfied many growers with their canning fruit plantings, and their tendency is to remove trees to make way for vines and other fruits. This, and the tree losses incurred after the wet 1968 winter, will cause a decline in overall production.

Prunes

After a light setting the MIA prune crop was further reduced by losses at maturity. Growers were unable to harvest fruit crops in the wet conditions that prevailed. In Young district a satisfactory crop was produced.

Estimates of 1968–69 production, supplied by the N.S.W. Dried Fruits Board, were 1,170 tons from the M.I.A. and 1,796 tons from Young, a total of 2,966 tons for N.S.W.

The steady rate of planting continued in the M.I.A. Planting at Young increased slightly but still insufficient to offset removals there.

Dessert Apricots

After a satisfactory setting of early apricots at Kurrajong, the dry spring and early summer caused poor development. Much of the matured crop was undersized and only part of it was marketed. Later supplies, from inland districts, were insufficient to satisfy the market needs.

Dessert Peaches

The crop at Forbes was completely destroyed by frost. Frost damage occurred also in the Bathurst and Armidale districts. Supply of early peaches from near-Sydney areas is gradually diminishing, as orchards are subdivided for housing developments.

Overall, except for a short time when coastal Blackburns were being harvested, supplies were light and prices satisfactory.

The planting rate is static in all districts. New plantings are no greater in total than would replace old trees removed.

Cherries

At Young, after tree losses through drought in the previous season, cherry production showed some recovery; a crop of 15,600 cases in 1968–69. Production should rapidly increase to the pre-drought level of about 400,000 cases, as newer trees came through the drought period much better than older plantings.

At Orange, good crops of quality fruit were produced but heavy losses followed the rain toward the end of harvesting. Some 320 tons of white cherries were delivered to the brinerries. Moderate crops of excellent quality were produced.

On the northern tablelands the crops were moderate but excellent quality.

The survey of drought effects in the Young district revealed the loss of 57,000 cherry trees, equivalent to 25 per cent. Most of them were mature trees. New, 1969 plantings are expected to exceed 60,000 trees at Young. Increased plantings are being made at Orange and on the northern tablelands.

STRAWBERRY INDUSTRY TRENDS

Rutherglen bug and thrips infestations reduced strawberry yields. Production has been estimated at about 500,000 punnets for 1968–69, as for the previous year but from a bigger acreage.

The acreage planted to strawberries has substantially increased this year. Plant establishment has been excellent, the weather has been favourable, and a crop increase to a million punnets could be achieved.

NUT INDUSTRIES

Pecans and Walnuts

Overseas interest in developing the pecan and walnut industries in N.S.W. has been apparent. Their development depends on production sufficient to warrant introduction of processing plant and machinery. Land settlement and water-rights policies present some difficulties in the way of large-scale enterprises such as are envisaged. But negotiations are in progress towards resolving the problems.

Regulatory Services by Division of Horticulture

LEGISLATION

Plant Diseases Act

A number of the regulations and proclamations under the Plant Diseases Act were reviewed. As a result, recommendations have been made to repeal fifteen redundant proclamations and also Regulation 49.

Some of the fruit grading regulations have been discussed with industry representatives. As a result, recommendations have been made to repeal Regulations 19, 20, 21, 22, 23, 23A, 24, 25, 34, 35, 38, 39, 40, 44, 50, and 52, and new regulations have been drafted for the grading of potatoes, citrus, stone fruits, bananas, berry fruits, and miscellaneous fruits. Also, amendments to Regulation 43 have been prepared concerning grading of tomatoes.

Initial steps have been taken to amend the Act also to provide more effective procedures in enforcing grading regulations.

After *Sclerotinia laxa* was identified in stone fruit orchards in southern Victoria, a proclamation was gazetted to provide for restrictions on movement of fruit into N.S.W. from the infected area.

Wine grape growers of the Hunter Valley have asked for quarantine protection against introduction of grape pests and diseases. This is under consideration.

Fruit Cases Act

Regulation 1 under the Fruit Cases Act was repealed and a new Regulation 1 was gazetted—listing the approved packages for marketing of fruit.

Potato Growers Licensing Act

Amendments to the Potato Growers Licensing Act and to Regulation 3 were gazetted to provide for license fee increase to \$4.

Horticultural Stock and Nurseries Act

The Horticultural Stock and Nurseries Act was passed during the first session of Parliament in 1969. This new Act provides for licensing of nurserymen and resellers, labelling of nursery stock and approved propagating material. The necessary proclamations and regulations are now being drafted.

Banana Industry Act

The Banana Industry Act was passed in April, 1969. It provides for a poll of growers on whether a Banana Marketing Committee comprising growers' representatives together with consumer and Departmental representation should be constituted. Regulations and rolls for the poll are being prepared.

PROSECUTIONS AND WARNINGS

Twenty-one prosecutions were conducted for the following classes of market offence; failure to remove old brands (3), failure to brand cases (6), misdescription of grade (7), breach of M.I.A. quarantine (3), breach of fruit fly proclamation (2).

Also information has been lodged in court in respect to fourteen market offences. These, awaiting hearing, are as follow: failure to remove old brands (1), failure to brand cases (2), excessive size variation (1), "topping" (3), bunch facing cherries (2), misdescription of grade (1), selling immature fruit (1), breach of M.I.A. quarantine (3). And informations have been lodged with the Legal Branch recommending prosecution for twenty other offences.

Amongst the other regulatory actions were sixty letters of warning and also the seizure of fifty-one consignments of immature grapes.

PLANT QUARANTINE STATION, RYDALMERE

The Plant Quarantine Station at Rydalmere, built to provide for the post-entry quarantine of plants, is now operating. Fruit Officer Mr W. A. Turnbull has been appointed Officer-in-Charge.

WHEAT QUARANTINE STATION, TAMWORTH

With funds from the Commonwealth Department of Health, the establishment of a quarantine station for wheat varieties introduced into Australia is proceeding at Tamworth. It will be in association with the Australian Wheat Variety Collection, regulating the introduction and breeding of new varieties throughout Australia. Ultimately, all wheat varieties imported into Australia will undergo their quarantine at Tamworth. The preceding situation has been that wheat quarantine was done by various authorities, in all States.

FRUIT FLY CAMPAIGN

The Whole-Town Treatment Scheme for Queensland fruit fly control was this year adopted for the first time by Local Government at Young, Scone and Peak Hill. On the other hand, the coastal towns of Windsor and Richmond discontinued the Whole-Town Treatment.

Level of control achieved by the Scheme was good, even though conditions in most areas favoured fruit fly. In many untreated areas the fly was very active.

It was pleasing to report the absence of fruit fly from the Murrumbidgee Irrigation Areas, and as a result citrus from the M.I.A. may now enter New Zealand without restriction.

An area certificate of freedom from fruit fly for three years has been accepted by South Australia in respect to the N.S.W. Sunraysia-Broken Hill-Menindee area. Inclusion of Broken Hill-Menindee is outcome of the successful Town Treatment Schemes. It is anticipated that at least four more towns will adopt Town Treatment in this coming season.

OTHER PEST AND DISEASE WORK

With *Red scale* a major problem in the inland citrus areas, regulatory action had to be applied at the city markets to a number of infested lines.

In many districts *San Jose scale* was again a problem and caused regulatory rejection of some export fruit.

Eradication measures against *citrus red mite*, undertaken in 1967-68, appeared to have controlled the outbreaks. No evidence of this red mite was detected at any of the sites during the 1968-69 season.

An outbreak of *banana bunchy top* in the Tweed district in the autumn was dealt with by eradication action and the position is now satisfactory. The control campaign in the quarantine districts continued throughout the year and the situation overall is normal.

In the N.S.W. Sunraysia area *Nematode* inspections were done on 184,000 grapevine rootlings while 580,000 were hot water-treated under supervision. The Corowa-Barooga district was surveyed to determine distribution of the burrowing nematode (*Xiphinema index*), the vector for grape fan leaf virus. Soil and root samples were collected. Their examination by Biology Branch failed to reveal presence of the species.

In banana districts, *ante-nematode treatment* of planting material continued under Departmental supervision. At Coff's Harbour 14,325 banana plants were heat-treated; also 42,519 in the Brunswick and 23,800 in the Richmond district.

In the M.I.A. the extent of *virus infected peach trees* was surveyed with officers of Biology Branch. Examination of "suspects" is continuing. Also, in the Kurrajong district, *apricot trees* suspected of virus infection were surveyed.

The appearance in Queensland of *maldison-resistant strains of Rust Red Flour Beetle* posed serious problems, maldison being a routine treatment to prevent insect infestation of wheat and other grain exports. To ascertain whether N.S.W. had acquired resistant strains of the pest, fruit officers, fruit inspectors and agronomists did a Statewide survey (silos, produce merchants and stock food manufacturers). Six instances of maldison-resistant beetles were recorded in N.S.W. Regulatory action was taken to kill the strains in the premises where they were located. This work is continuing.

INTRA-STATE QUARANTINE

At request of Hunter Valley wine grape growers draft legislation for introduction of quarantine protection for this area has been prepared for consideration by their Association.

Quarantine measures in the M.I.A. were actively policed, but the lack of natural barriers to introductions makes complete enforcement impossible. Controlled entry of bananas worked satisfactorily, and consideration is now being given to controlled entry of certain other fruits if subject to post-harvest disinfestation treatment.

Banana bunchy top and beetle borer campaigns continued in the banana quarantine areas with the support of the Banana Growers' Federation. A campaign is now operating in the southern banana areas to contain and control the beetle borer.

MARKETING OF IMMATURE FRUIT

Grapes.—Queensland Department of Primary Industries again conducted grape maturity testing on consignments being forwarded to Sydney. From the start of this service, there has been very little incidence of immature Queensland grapes on the Sydney market—in contrast to the previous situation. Most of the immature grape consignments seized this year were from the south, the mid-Murray area; predominantly interstate.

Citrus.—There was very little incidence of immature citrus at marketing. Starting with the 1969 season, citrus maturity is based on the Brix/acid ratio instead of an acid titration.

FRUIT PRESENTATION

Efforts made in most districts improved the presentation of fruit. While more can be done, good progress has been made. Interestingly, particularly with pome fruits, the market is showing more definite preferences for particular containers. For example, apples in the old standard bushel case are at a discount compared with similar fruit in the traypack carton.

SYDNEY CITY MARKETS INSPECTIONS

Fruit—Quality and Supplies

Apples.—In the good supplies of old season apples that came forward until early November, with odd consignments into December, controlled atmosphere (CA) stored apples realized high prices, and—as happened last year—some fruit was being branded CA in deliberate attempts to mislead the buyer.

The new season has so far put large quantities continuously on the market. Their grading and branding have been reasonable, but some down-grading is regular.

Pears.—The new season's pears have been in short supply. Quality generally has been good. Grading of Victorian pears has improved, with most lines being marked "Good" grade—from the larger sheds.

Stone Fruit.—With *cherries*, though in good supply, smallness was a problem. *Apricots* were in moderate supply early, and usually small and blemished, but quality improved as supplies came forward from Menindee and the M.I.A. *Peaches and Plums* were in light supply early, poor in size and colour; midseason supplies moderate to heavy, but size still lacking. Late varieties improved to average quality. More peaches and plums came forward in trays. Quality, good size fruit was always in demand. *Nectarines* were in short supply throughout the season and generally poor in size and colour, but consignments from inland had better colour.

Grapes.—Grapes were available from Queensland at Christmas. Tests for immaturity resulted in a few lines being seized. When supplies later came from local areas quality was good except for size. Sultanas came forward from Murray Valley districts and M.I.A. until heavy rains in early February caused heavy losses and put an early close to the season. Queensland sent more, later maturing varieties of grape than usual.

Oranges.—Moderate supplies of old season Navels extended into the Valencia season. Valencias matured early and from September were in heavy supply throughout the season; late consignments showed a fair amount of "re-greening", and growers resorted to gassing which led to some breakdown. Late M.I.A. consignments were heavily blemished by red scale, and live infestations were fumigated with methyl bromide. New season Navels have been in short supply, from Queensland and local sources; internal colour of Queensland fruit was poor but local Navels have been of good quality and in demand.

Other Citrus.—*Lemons* were in moderate supply throughout the year, in average to fair quality and strong demand. *Mandarins*, in moderate supply throughout the year, were mostly from Queensland—attractively presented and superior in quality to those from N.S.W. Local growers are increasingly using attractive $\frac{1}{2}$ -bushel cartons, but fruit quality is lacking.

Grapefruit, mostly in short supply, were in such demand that all fruit sold though quality was poor in some instances.

Bananas.—Quality and presentation were generally good, but there was some undersized fruit requiring regulatory action. Mixed ripe was not a problem in the summer, but in the autumn there was some mixed ripe and also fruit with rust thrip damage.

Other Tropical Fruit.—*Pineapples*, in good supply throughout the season and of good quality, showed little blister or breakdown as compared with past years. Their packaging in fibre-board cartons, more and more popular, has been well received by the trade. *Custard Apples*, in fair supply throughout the season, included some consignments disfigured by mealy bug damage. *Avocadoes*, in good supply throughout the season, were of good quality generally, in strong demand, and usually in single layer cartons. *Mangoes*, in average supply, excellent quality, and here again more cartons were being used. *Papaws*, in good supply throughout the year but their quality often poor because of weather damage.

Passionfruit.—Supplies lighter this year but quality good; mainly from Queensland and north coast areas.

Strawberries.—Adequate supplies throughout the year, from N.S.W., Queensland, Victoria and New Zealand, and the packing and presentation by N.S.W. growers had noticeably improved.

Tomatoes.—In moderate supply. Queensland supplied most of the fruit in winter. North coast districts continued to supply increasing amounts in early spring. Local glasshouse crops continued to lessen in quantity—the gap filled by earlier local field crops, South Australian sources and late Queensland supplies. As summer approached local field crops supplied the market.

Main faults were Mosaic virus, radial cracks and malformation. Breaches of the grading regulations were found (mainly in the Growers Section of the Market) but quality and presentation showed a marked improvement this year.

Potatoes.—Bags of potatoes inspected at Perry Park and Alexandria totalled 1,160,036; a reduction of 128,892 on last year. Of the total: 71,421 were withheld from sale for contravention of the Potato Grading Regulations. Some 2,805 bags were infested with potato moth, 263 bags infested with nematode and 621 bags affected by late blight.

Regulatory action had to be taken also against a number of growers in the Growers Market; mainly for wrong grading or unbranded bags or boxes.

Other Vegetables.—Supplies of vegetables in season were plentiful, and for many lines there were glut periods. The castaway certificates issued involved 1,346 consignments totalling 21,713 packages of produce.

EXPORT INSPECTIONS—FRUIT AND VEGETABLES

Containerization for export fruit shipments was the most significant development of the year. This introduction necessitated change in export fruit inspections, with final inspection at the point of loading the container—generally within the producing district.

For export of pears, tighter controls were introduced for the 1969 season because of failure of certain packers and exporters to abide by conditions.

Many packers and exporters do not take enough care in selecting and presenting fruit for export. The necessity this year to reject 10,714 bushels of apples presented for export illustrates this—the more so in light of the reasons for rejection. Legal proceedings against one exporter have been recommended.

Apples.—122,407 bushel cases and cartons of apples were exported from the Port of Sydney, but 34,536 of these were from Queensland. The total was 56,145 bushels higher than the previous year's. Some 80 per cent of the apples went to the United Kingdom and the Continent; 4,969 bushels were shipped to the U.S.A. and subjected to in-transit sterilization; the remainder were shipped to South East Asian and Pacific Island destinations.

Rejections due to Bitter Pit, broken skins, bruising, San Jose scale and high core temperatures totalled 10,714 bushels. Otherwise the quality of the fruit was good.

Pears.—12,572 cases were shipped; about 5,000 less than a year earlier. Main destinations were South East Asia and Pacific Islands. Two shipments (2,104 cases) were shipped to the U.S.A. and were in-transit sterilized to satisfy quarantine needs.

Oranges.—81,218 bushels were exported through Sydney; 23,676 cases less than in the previous year. Most were to South East Asia, and a small percentage to the Pacific Islands. Rejections were practically nil. By far the bulk of the N.S.W. citrus exports (about 220,000 bushels) were shipped through Melbourne.

Mandarins.—4,904 bushels were exported (most to Canada); an increase on last year by about 1,830 cases. Quality was high.

Lemons and Grapefruit.—1,355 cases of lemons and 1,068 cases of grapefruit were exported; all to Pacific islands.

Grapes.—13,346 (mostly $\frac{1}{2}$ -bushel) cases were exported; 9,500 cases less than last year. The grapes went mainly to the Philippines and were subjected to in-transit cold sterilization. Small quantities went to Pacific island destinations. Rejections totalled 226 cases (for insufficient cork).

Stone Fruit.—Peaches, plums, apricots, cherries and nectarines were exported. The total was 26,356 cases; about 2,050 cases less than in the previous year. Almost all went to the Pacific islands.

Strawberries.—1,094 cartons of strawberries were shipped.

Tomatoes.—21,025 cases were exported; 18,280 fewer than last year—due mostly to loss of contracts to supply U.S. Armed Forces in the Philippines.

Vegetables.—126,414 packages of various vegetables were shipped, mainly to Pacific islands; an increase of 4,300. There were rejections; due mainly to soil contamination and insect infestation.

EXPORT INSPECTIONS—WHEAT AND OTHER GRAINS, FLOUR AND GENERAL

Here, too, containerization has brought changes in export inspection procedures—with point of shipment inspection transferred to the point of loading the container (e.g. flour mills, metropolitan and country). The changes have added difficulties and cost to the necessary inspectional services.

Wheat.—Wheat inspection continued throughout the year at Sydney and Newcastle, although not as constant as in the previous season. A statistical summary is:

Port	Wheat ships		Tons of wheat	
	Surveyed	Not passed (for cleaning, spraying, fumigation reasons, etc.)	Loaded	Rejected
Sydney	77	5	1,323,295	3,050
Newcastle	60	9	595,958	3,188
Totals	137	14	1,919,253	6,238

Total wheat exports decreased by 638,121 tons, on the previous year. Bagged wheat included in the foregoing comprised: Sydney 1,652 tons and Newcastle 2,180 tons; total 3,833 tons.

Flour: 89,206 tons of flour was shipped; 16,000 tons less than in the same period last year. Main destinations were Singapore, Pacific islands, Ceylon, Indonesia, Port Louis and the United Kingdom. Rejections comprised 123 sacks (rain damaged or dirty). General standard of export packaging was good, with no sign of insect infestation.

Rice.—Rice exports dropped by about 20,000 tons to 76,610 tons; mainly shipped to New Guinea and Pacific islands, with one big shipment to India. Only a small quantity was rejected, for larvae on bags.

EXPORTS—GENERAL

International Health Certificates.—These totalled 5,184, and covered 56,687 packages. This Certificate concerns goods not requiring an export permit; e.g. small quantities of seed, nursery stock, cut flowers.

Export Permits.—These were issued for a total of 8,979 packages comprising: pasture seed (4,882), bird seed (433), field peas (1,133), vegetable seed (801), tree seed (25), nuts (411), maize (281) and cereal (1,013).

COMMONWEALTH QUARANTINE INSPECTIONS

General

Containerization had a major impact on quarantine services conducted on behalf of the Commonwealth Department of Health. Quite new quarantine procedures had to be developed to provide the needed safeguards without delaying movement of containers. Preparations made over the past 2 years by the Commonwealth in consultation with the States and the major container operators provided relatively smooth introduction of the services. Co-operation from the container consortiums has been fine.

Changed customs procedures.—The efforts to provide more rapid clearance of overseas passengers, and the substantial increases in work volume, have imposed more stress on the available staff. Provision has been made for additional staff, but it has not been possible to fill all vacancies.

The *Department's Seed Testing Laboratory* again assisted quarantine by examining samples of imported seeds for presence of contaminants, etc. Of the 550 samples submitted there, 102 contravened provisions of the Quarantine Act—mainly because they contained prohibited weed seeds.

The Laboratory hand-cleaned ninety-eight samples (trade, experimental, or small-packet samples) to facilitate release. Some ninety specimens of suspect origin were extracted from the samples and forwarded to the Biology, Entomology or Botany laboratory for identification and comment.

Overall.—The volume of plant quarantine material handled over the past 12 months has continued the steady increase previously apparent. The total of applications lodged for a plant quarantine clearance increased from 36,000 last year to 41,700 in 1968–69.

Imported Nursery Stock

The quantity of nursery stock imported showed an increase of 1,273 plants over the previous year. A total of 12,653 plants held under the regulations included 6,475 orchids, 1,932 ornamentals, 1,440 succulents and cacti, 48 aquatic plants, 1,062 bulbs and rhizomes, 1,323 rose budding eyes, 94 sugar cane cuttings, and 279 grapevines. With completion of the new Quarantine Glasshouse at Rydalmere in December, 1968, the grapevine propagating material was introduced from European sources for Departmental use.

Initial inspections revealed little disease or pest except mites and aphids. One importation of rose-budding eyes had a fungal canker. A big consignment of *Dianthus* from Switzerland was destroyed because of virus.

Except for the grapevine introductions, all the aforementioned stock has been grown in private quarantine houses. Post-entry examinations during the growing period has revealed some instances of disease warranting destruction of the introduced material.

Parcel Post Inspections

All goods and articles subject to quarantine regulations, arriving from overseas through the parcels post at Sydney Mail Exchange are examined. This year 10,394 parcels and packages were withheld for inspection, and 1,541 of these were detained for further examination, treatment, or destruction as the case required.

Ship, Waterfront, and Aircraft Inspections

Overseas Passenger Vessels.—268 overseas passenger-vessels were attended on arrival, for inspection of articles brought to inspectors' attention by Customs officers. Large quantities of goods were held for treatment or destruction.

Mascot Air Terminal.—The flights into Mascot Airport increased again this year to 6,693 and the number of overseas passengers to 603,870, an increase of almost 100 per cent in two years. Items held and forwarded to Export and Import Branch for decision increased to 540. Prohibited goods intercepted and abandoned—including fruit, vegetables, seed, plants, etc.—increased to 273 quarantine bags (about 30 lb each) which subsequently were destroyed.

Bond inspections totalled 1,676 consignments. These included perishables such as berryfruits from New Zealand. Export items cleared at the Airport comprised 720 consignments, mostly cut flowers.

Richmond Air Station.—Flights into Richmond, N.S.W., increased slightly to 423. These carried 19,895,000 lb of cargo and 2,779 passengers. Goods quarantined included pallets, cases, curios, fruit, etc. U.S.A.F. parcel-post yielded a normal range of restricted items requiring treatment or destruction.

Personal Effects.—Inspections by appointment this year totalled 1,089 and the number of pieces examined was 32,382. Of these, 645 pieces were quarantined and treated, or destroyed.

Containers.—Over the last 12 months the total of containers arriving on conventional ships has increased considerably. The first container ship, "Encounter Bay", arrived on 3rd April, 1969, and several have arrived since from the United Kingdom and New Zealand. They are arriving at shorter intervals and later this year will average one a week. This has meant continuous manning of Chullora and Villawood depots, as well as needing an inspector full time at the Day Street address.

Cases and Packing.—The Sydney waterfront was manned throughout the year by three inspectors, each responsible for a section. They were kept fully occupied inspecting general

cargo, pallets, dunnage, interstate cargo under bond, outsiders of containers, etc. This resulted in the interception of considerable quantities of cargo contaminated with prohibited material, woodboring insects, straw packing, used sacks, etc.

Timber.—Total imports into N.S.W. were 252 million super feet, representing a 16.6 per cent increase on the previous year. *Pinus radiata* from New Zealand and oregon from North America increased by almost 40 per cent, while imports from Malaysia decreased by 25 per cent.

The total timber quarantined was about 4½ million square feet, a decrease of 16.5 per cent on the previous year. This no doubt was the result of smaller imports from Malaysia which, averaging 7.8 per cent infestation, was the most troublesome timber.

The Port of Ballina commenced landing New Zealand radiata pine this year, and inspection and clearance are proceeding smoothly. Carpenter ants were present in dunnage in several ships from North America, and most stringent measures were needed to ensure eradication. *Sirex* Wood Wasp has been found in several consignments of packing cases and these were fumigated immediately.

General Wharf Inspections.—1,031 overseas ships were visited this year, to inspect goods requiring a Quarantine Permit before release. These included such items as coffee, cocoa, dates, pasture seed, motor vehicles, legumes, peanuts, all cargo from India, Pakistan, and Ceylon, cotton, all bamboo ware, etc.

The total of motor vehicles increased to 23,186. Of these, 2,106 were second hand and 979 required steam-cleaning for removal of soil. Little soil was found on the new vehicles, but 1,379 were quarantined for removal of prohibited seed contamination such as wheat, maize, etc.

Bean seed (*Phaseolus*), imported from Idaho, U.S.A., for growing, totalled 4,343 sacks; beans, imported for processing and released after treatment, totalled 20,146 sacks. Due to weakness of the bags, spillage contaminated much general cargo, and cleaning had to be done—under supervision.

Presence of foreign seeds was responsible for 1,038 sacks of various spice seed being cleaned or ground under supervision; 193 bags were fumigated for insect infestation. Of 34,718 sacks of soybean meal imported, 7,786 sacks required fumigation for insect infestation, as did 336 sacks of sunflower from South Africa. A shipment of 425 sacks of onions from Japan was quarantined and processed under supervision due to *Fusarium oxysporum* infection.

To comply with Customs (Narcotics) requirements, 290 bags of poppy seed (opium) identified were devitalized. Some 408,605 bags of copra were quarantined and processed under quarantine control, and the bags heat-treated. Following local crop failures, 4,426 tons of safflower and 3,321 tons of linseed were landed, transported, and processed under supervision.

Inspections at Quarantine Station, Day Street.—The total of quarantine inspections was 7,485. This was a slight decrease on the previous year, due to a new system of Customs control introduced in August, 1968. Movement under permit to Day Street for inspection has not always been honoured, consequently inspectors have been forced to do more inspections on the wharf and only allow agents who are trusted to bring goods to the Quarantine Station.

INSPECTION STATISTICS—N.S.W. PORTS

Exports ex N.S.W. Ports	1967-68	1968-69
Fruit and Vegetables:		
Apples	66,262 bushels	122,407 bushels
Pears	17,585 cases	12,572 cases
Oranges	104,898 bushels	81,218 bushels
Mandarins	3,074 bushels	4,904 bushels
Grapefruit	1,967 bushels	1,068 bushels
Lemons	1,866 bushels	1,355 bushels
Apricots	2,931 packages	1,949 packages
Peaches	10,630 packages	13,581 packages
Plums	6,377 packages	4,795 packages
Cherries	6,923 ½ boxes	4,567 ½ boxes
Nectarines	1,547 packages	1,464 packages
Grapes	22,875 cases	13,346 cases
Tomatoes	39,305 cases	21,025 cases
Vegetables	122,139 packages	126,414 packages
Strawberries .....	.....	1,094 cartons
Grain and Flour:		
Wheat (bulk)	2,555,374 tons	1,915,420 tons
Wheat (rejections)	79,000 tons	6,238 tons
Wheat (bagged)	2,600 tons	3,833 tons
Flour	105,415 tons	89,206 tons
Rice	96,723 tons	76,610 tons

Imports:	1967-68	1968-69
Nurseries imports	11,380 plants	12,653 plants
Parcel post	10,157 packages	10,394 packages
Parcels detained for examination	1,236 packages	1,541 packages
Overseas flights into Mascot	5,833	6,693
Overseas flights into Richmond	434,830	603,870
Their passengers	351	423
Their passengers	2,800	2,779
Overseas flights—Freight	17,725,000 lb	19,895,000 lb
Passenger ships	272	268
Personal effects—Appointments	1,942	1,089
Personal effects—Articles	50,308	32,382
Timber	216,000,000 s. ft.	252,000,000 s. ft.
Timber quarantined	5,344,000 s. ft.	4,500,000 s. ft.
Quarantine permits	36,000	41,700

DIVISION OF ANIMAL INDUSTRY

General

PROFESSIONAL STAFF

Retirements/Promotions/Vacancies

Principal Veterinary Officer (Meat Inspection) Mr R. C. Cramp and Principal Livestock Officer (Sheep and Wool) Mr C. J. Hawkins retired. Mr P. Brydon is now Principal Veterinary Officer (Meat Inspection) and Mr R. D. Eastoe is Principal Livestock Officer (Sheep and Wool).

Four veterinary research officers were appointed, one resigned, and there is one vacancy; nine livestock research officers were appointed, four resigned, and there is one vacancy; one research officer position is vacant, through a resignation; ten livestock officers (sheep and wool) were appointed, one resigned and one retired, but there is no vacant position; six livestock officers (beef cattle) were appointed and two resigned, but there is no vacancy; three livestock officers (pig) were appointed, two resigned, and there is one vacancy; two livestock officers (poultry) were appointed, one resigned, and there is one vacancy; and one livestock officer (apiculture) was appointed, leaving no vacancy in that section.

Advanced Degrees

Livestock Research Officer Mr B. R. Wilson was awarded the M.Rur.Sc. degrees by the University of New England. District Veterinary Officer Mr R. E. Everett was awarded a Diploma in Animal Health by the University of London. Veterinary Inspector Mr C. F. Cargill was awarded a Master of Science degree by the Alabama University, U.S.A. Ten officers of the Division have been engaged this year on research aimed at Ph.D. degrees. Two of them are at overseas universities and eight at Australian universities.

Officers Overseas

Eight officers of the Division were overseas for the whole or part of the year: Senior Livestock Officer (Apiculture) Mr F. S. Benecke visited New Zealand to study methods of honey production, refining, and marketing—with particular interest in honey produced from white clover; Veterinary Inspector Mr C. F. Cargill, at the University of Alabama, U.S.A., on a Rotary International scholarship, is studying for the M.Sc. degree; Veterinary Inspector Mr C. R. Dent at the University of London is studying for the Diploma in Animal Health; Assistant Principal Veterinary Officer (Exotic Diseases) Mr D. A. Dickinson visited New Zealand for a course on exotic diseases and to investigate control of hydatids; Veterinary Research Officer Dr I. K. Hotson studying at the Moredun Institute, Scotland; Livestock Research Officer Mr G. I. G. Lee at the University of California, U.S.A., doing research for the Ph.D. degree; Research Officer Mr J. Nolan at Cornell University, U.S.A., doing research for the Ph.D. degree; and Livestock Research Officer Mr B. R. Wilson at the University of Alberta, Canada, doing research for the Ph.D. degree.

NEW VETERINARY BUILDINGS

The new wing at the Veterinary Research Station, Glenfield to provide facilities for virology research, serological testing and staff amenities has now been occupied, though installation of engineering needs of the virology section were not finalized. Construction of additions to the parasitology section of the same station has started.

Livestock Health—Field Activities

REGULATORY DISEASE CONTROL

Tuberculosis (Cattle)

Quarantine Areas Scheme.—The programme initiated in 1960, of compulsory testing of all cattle within quarantine areas was continued. Two more areas were established, making eighty-two in all. All are in predominantly dairying districts. Testing was done in seventy-five of the areas this year. Routine herd tests were mostly done by practising veterinarians, at Government expense. In some remote areas the tests were done by Departmental veterinary officers. The latter also did the retests of herds where there were reactors.

Tested cattle totalled 684,969, as against 845,516 in the previous year. The lower total was because of the increased total of areas where testing is now at two-year in lieu of yearly intervals, through lower incidence of the disease. Moreover, in areas within the Cattle Tick Quarantine Area, where supervision over cattle movements is close, testing is at 4-year intervals—except that if a herd has previously been found infected the interval is 2 years.

Reactors to testing under this scheme totalled 520 or 0.08 per cent, a slight reduction on last year's 0.09 per cent, and the lowest reactor percentage since the scheme started. The total of cattle needing re-test fell from 55,055 last year to 42,592, but reactor incidence in this class rose slightly—from 0.64 to 0.71 per cent.

Lesions of tuberculosis were not detected in 41.5 per cent of the reactors, as against the previous year's 33.5 per cent, but the no visible lesion (NVL) reactors comprised only 0.03 per cent of tested cattle—as in the previous year.

In two herds with a long history of indefinite reactions to the tuberculin test at repeated testing the causal organism was identified as non-chromogen of Runyon's Group III (Battey type).

Isolates identified as scoto-chromogens were cultured from milk from a further herd wherein reactors had been regularly detected since testing started in 1960. A test this year revealed 38 reactors out of 151. A subsequent re-test disclosed 53 reactors, including calves under 3 months of age. Three children who had consumed milk produced by this herd developed tuberculosis. The scoto-chromogens belonged to either Runyon's Group II (slow growers) or Runyon's Group IV (rapid growers).

In several herds where there was difficulty in eradicating tuberculosis by the single intradermal test, a modified Stormont and the short thermal test were used in ancillary roles. Confirming previous experience, the short thermal test was very valuable in detecting advanced cases but less efficient in revealing cows with small lesions. The short thermal and modified Stormont tests detected some infected cases which had not reacted to the single intradermal test.

"Skin" tuberculosis complicated the tuberculin test in several herds. In fact, ten herds were believed to be involved, though not all presented appreciable problems. All of these were in an area about 20 miles square in the Hunter River Valley.

The manager of a herd being tested indicated that a cow which was negative when the results were being read at the 96th hour had shown a reaction at the 72nd hour. This cow was slaughtered and showed a bronchial lymph gland lesion containing numerous acid-fast organisms. In the second case, an animal which behaved similarly was not slaughtered, but the next test of this herd was read at the 72nd hour. This animal showed a reaction which disappeared 8 hours later. On slaughter, lesions were found in the pharyngeal lymph gland.

Because of these occurrences, the 72nd and 96th hour readings were compared in a herd where there were thirteen reactors of which eight were NVL. The reading at the 96th hour would have reduced the recorded incidence of NVL reactors by one, but would possibly have missed one generalized case of tuberculosis, in comparison with the reading at the 72nd hour.

Tubercle-free Herd Scheme.—Under this voluntary scheme of accreditation 66 herds and 10,206 head of cattle were tested. There were four reactors. Thirty-one other herds were not tested, having been accredited during the previous year for two years.

Tubercle-free Milk Schemes.—In one of these schemes, administered by the N.S.W. Milk Board and applying to the larger cities, 24 herds containing 10,527 cattle were tested. There were 18 reactors.

In the other scheme, operating mainly for the small cities and towns and supervised by Municipal and Shire Councils, testing was done in 31 areas. Tested cattle totalled 4,833. There were two reactors.

Both schemes are designed to ensure that raw milk sold for human consumption is produced by herds accredited by the Department of Agriculture.

Miscellaneous Testing.—This included compulsory testing of infected herds outside quarantine areas, and voluntary testing for export, sale, exhibition, or diagnostic purposes. Tested cattle totalled 31,083. Of these, 272 reacted.

Comparative testing of 134 head of cattle was done on a property from which three bulls that had been sold had later given doubtful reactions to the tuberculin test but showed generalized lesions of tuberculosis on slaughter. The test was done in the skin of the neck and caudal folds; using mammalian, avian, and Battey strains of tuberculin. One animal was classified as positive to mammalian tuberculin injected in the neck region, while 13 had doubtful caudal fold reactions to mammalian tuberculin. Reactions generally were more marked in caudal folds, and more obvious to the avian and Battey than to the mammalian tuberculin. The positive reactor was slaughtered and showed no lesions of tuberculosis. Two doubtful reactors to mammalian and two to Battey tuberculin were negative on re-test by the short thermal method.

Tuberculosis (Pigs)

The herd referred to in last year's report as infected with the non-chromogen of Runyon's Group III classification (Battey type) was investigated as were three more herds wherein organisms of this type were found.

Identification was undertaken by the Institute of Clinical Pathology, Department of Public Health. The Institute referred some of the isolates to Dr W. B. Schaefer, National Jewish Hospital, Denver, U.S.A.

Three isolates from pigs on one of the properties were classified as serotype Davis while two others were unclassified. Three of four isolates from a second piggery were classified as *Mycobacterium avium* II while another comprised a mixture of *M. avium* II and serotype Kansaii. One isolate from another piggery was classified as serotype Davis.

All four herds were initially held in quarantine. They were later released because of evidence of widespread distribution of Battey type tubercule bacilli which were generally of low pathogenicity.

Investigations were made in a stud piggery after total condemnation (for tuberculosis) of a carcass entered in a judging competition. Tests of groups revealed a 60 to 70 per cent reactor rate in pigs of porker weights upward. However, only three of twenty-six reactors which were slaughtered revealed tuberculosis lesions. Typing of the causal organism had not been completed at the end of the year under report. A feature of the testing was that pigs generally were more sensitive to avian than to mammalian tuberculin, and a group of pigs not being fed milk was free of infection. The milk used for pig feeding was that rejected by a local milk depot, though all supplying dairy herds had been tested for tuberculosis.

This year five herds were placed in quarantine, and quarantine was continued for two other herds whereon restrictions were placed in previous year. Six of these herds were later released. Tuberculin testing was done on fifteen properties: 766 pigs tested, and 203 reactors detected.

Tuberculosis (Poultry)

Twenty properties were placed in quarantine on account of avian tuberculosis as against twenty-six in the previous year. Quarantine continued on thirty-four other properties, previously quarantined. Twenty-seven properties were released.

Of the outbreaks detected, fourteen were in the south west, where incidence of the disease was highest in the past. The tuberculin test is used only in special circumstances; this year in five flocks. Of 905 birds tested, there were thirty-one reactors.

Anthrax

Thirty-one outbreaks were recorded this year; a typical year's total. All were in the recognized anthrax belt, in the west of the State.

One of the outbreaks, which involved three properties, was in the Moree district; the first in that district for over ten years. It followed flooding of the Gwydir watercourse country.

An outbreak in southern New South Wales involved the deaths of sheep which had been vaccinated twice against the disease. One outbreak was in a mob of cattle in transit by rail from Bourke to Victoria. Two cattle died and were removed from rail trucks. One carcass was fed to pigs, causing a further outbreak. The action caused two boys to become affected but both recovered in hospital.

Stock vaccinated this year totalled 211,354, on 223 properties; the greatest total vaccinated in any year. In accordance with official policy, ten stock routes whereon anthrax had occurred during the previous 5 years were quarantined. Use of these routes was restricted to stock that had been vaccinated against anthrax or were being transported by motor vehicle.

The following table shows the distribution of this year's anthrax outbreaks:

Administrative district	Outbreaks	Stock quarantined				Deaths			
		Cattle	Sheep	Pigs	Horses	Cattle	Sheep	Pigs	Horses
Central West	2	77	3,573	145	6	..	..	10	..
Far West	3	..	7,013	..	..	..	227	..	..
North West	3	3,013	3,668	..	..	46	..	..	..
South West	13	126	21,565	140	..	3	150	15	..
West	10	453	19,446	211	19	1	149	9	..
Totals	31	3,669	55,265	496	25	50	526	34	..

Pleuropneumonia Contagiosa (Cattle)

No outbreak occurred. A serum sample, part of a series being routinely collected from cattle at the time of slaughter at abattoirs, reacted to the complement fixation test. A test of the remaining cattle on the property concerned revealed a doubtful reactor, and at re-test 4 weeks later this animal gave a positive reaction. It was slaughtered but had no lesion of pleuropneumonia. However, it showed a necrotic lesion on the peritoneal surface of the rumen from which a Gram negative organism, having an immunogenic relationship to *Mycoplasma mycoides* in rabbits, was isolated. Studies on the organism are continuing.

Further reactions resulted from routine tests, but all of these animals were subsequently negative except one. This one was slaughtered but showed no evidence of pleuropneumonia. The incidence of false positive reactors was largely due to adoption of a more sensitive test recommended by the CSIRO.

A case of the illegal use of pleuropneumonia vaccine by an owner was detected.

In all, 13,100 cattle were tested this year; mainly for movement and export requirements and survey purposes.

Johne's Disease

A clinical case occurred on each of two properties. Both animals were slaughtered and each diagnosis was confirmed. On one property the disease had occurred periodically for the past 20 years. Three head of cattle closely related to the affected animal on this property were subject to the complement fixation test. One of these animals proved doubtful and was to be retested. This property had also supplied the bull which was the clinical case on the second property. The dam of this bull was also destroyed but proved negative for Johne's disease.

Footrot (Sheep)

For much of the year conditions were very favourable to the disease and it was more prevalent than at any time since 1956. In accordance with the recommendations of the CSIRO, the term "footrot" has been replaced by "virulent footrot", and the term "scald" by "benign footrot". This is because of evidence that strains of *Fusiformis nodosus* are associated with occurrence of both conditions.

Field officers had to devote much time to advising owners on control measures and in distinguishing between the two types of footrot, foot abscess and other foot conditions. On some holdings almost 100 per cent of individual mobs became clinically affected. The disease appeared on some properties for the first time since 1956, despite no introduced sheep. Moderate winter temperatures led to occurrence of many outbreaks in the winter, a period when the disease does not usually occur.

Vigilance was maintained, particularly at saleyards, on illegal movement of infected sheep. Action was taken to prevent infected sheep moving to other properties. One group of sheep found infected at a saleyard was returned 200 miles to the owner's property. In the south west, a

voluntary programme of eradication of the disease on three properties was officially supervised and eradication seems to have been effected on two of them.

In the Armidale Quarantine Area, comprising some 4,000 owners and 5,000,000 sheep, there were ten known infected properties at the start of the year. During the year nine more outbreaks were recorded. Conditions in the Armidale area were less favourable to footrot than in many parts of the State.

Eradication measures were deemed successful on thirteen of the nineteen holdings, leaving six affected—including two of the ten wherewith the year started.

On one property in the Armidale Quarantine Area, calves developed lesions closely resembling footrot in sheep and yielding organisms resembling *Fusiformis nodosus*. Sheep on this property were unaffected.

Brucellosis (Pigs)

Two properties were in quarantine for this at the start of the year, and quarantine was imposed on four others because of diagnosis. Restrictions were later removed from all six, after the disease was considered eradicated. One whole herd was consigned for slaughter. In the other cases, testing was continued until two herd-negative tests had been given. Nine reactors were detected and slaughtered.

In one herd a problem was caused by false doubtful and positive reactors. Re-tests, over some months, gave consistent results for individual pigs. Even so, the history and bacteriological findings on reactor pigs did not suggest presence of brucellosis. The serological reactions were finally attributed to unknown, non-specific causes.

In all, 888 pigs were tested this year; for sale, export and diagnostic purposes. The voluntary Brucellosis-free Herd Scheme was maintained, and twenty-one herds were accredited.

Pullorum Disease (Poultry)

Testing continued under the voluntary Accredited Flock Scheme and under the Stock Diseases Act regulations. The latter require annual testing of all flocks from which chickens under three weeks of age or hatching eggs are sold. The following is a summary of the voluntary and the compulsory testing:

Scheme	Flocks	Birds	Positives		Doubtfuls	
			Birds	%	Birds	%
Accredited flocks (Sydney Area)	63	660,007	408	0.062	559	0.084
Accredited flocks (Country Areas)	10	75,775	8	0.01	22	0.03
Total accredited	73	735,782	416	0.06	581	0.078
Compulsory testing (Sydney Area)	39	67,539	451	0.67	65	0.09
Compulsory testing (Country Areas)	11	18,350	52	0.28	57	0.3
Total compulsory	50	85,889	503	0.6	122	0.14

Seventy-three flocks were accredited under the voluntary scheme, while fifty were compulsorily tested under the Stock Diseases Act regulations. In comparison with the previous year, reactor incidence under the Accredited Scheme declined from 0.18 to 0.06 per cent. In flocks tested under the Stock Diseases Act regulations reactor incidence increased from 0.11 per cent to 0.6 per cent.

The District Veterinary Laboratory, Armidale, recovered *Salmonella pullorum* from cultures prepared from the liver, ovary, and small intestines of members of a row of layers (in a large cage-laying shed) which showed symptoms of diarrhoea. The owner killed out the affected row and there was no further trouble.

Trichomoniasis (Cattle)

Trichomoniasis was not diagnosed this year but its eradication was continued on a herd quarantined in the previous year. Measures included the recording of oestrus, the use of artificial insemination, and rectal examinations regularly to determine pregnancy status. The eradication programme was delayed by occurrence of anoestrus, of nutritional origin, in young cattle. Eleven cows that failed to become pregnant were consigned for slaughter, with compensation under the Cattle Compensation Act. *Trichomonas foetus* in large numbers was found in the genital tract of one.

External Parasites (Sheep)

The following table shows the number of holdings and sheep quarantined because of sheep lice (*Damalinia ovis*) and sheep ked (*Melophagus ovinus*):

Administrative area	Lice infestation		Ked infestation		Lice and ked	
	Holdings	Sheep	Holdings	Sheep	Holdings	Sheep
Central	19	27,537	..	..	..	..
Central West	142	141,390	19	11,038	3	7,401
Cumberland	11	4,331	3	395	..	..
Far West	65	241,282	..	..	..	..
North	289	371,366	50	67,334	5	4,620
North West	50	80,402	..	..	..	..
South	105	81,785	..	..	..	..
South East	72	105,041	29	24,074	9	12,390
South West	233	266,858	..	..	..	..
West	64	80,550	..	..	..	..
Totals	1,050	1,400,542	101	102,841	17	24,411

GENERAL DISEASE PROBLEMS

Brucellosis (Cattle)

Brucellosis was widespread in the State, and the most common cause of abortion in cattle. Occurrence of abortions was investigated in many individual herds, with the serum agglutination test as the basis of diagnoses. Strain 19 vaccine recommended for the prevention of the disease was widely used on a voluntary basis; its application restricted to registered veterinarians by Stock Diseases Act regulations.

Further testing was done as part of a survey, started in 1966-67, to determine incidence. As part of this survey, milk ring tests were applied to 2,331 samples at thirty-one milk receiving depots and milk products factories. Of these, 1,089 samples gave varying degrees of reaction and 1,242 were negative.

The survey in beef cattle involved collection of blood samples at abattoirs and from cattle on various properties. Some 3,765 samples were collected from individual cattle from 700 properties. Positive reactions to the serum agglutination test were given by seventy-eight samples, and thirty-seven samples gave doubtful reactions.

Investigations were made following reports from the Department of Health regarding *Brucella abortus* infection in ten persons, and advice was tendered on control of the disease.

For diagnostic, sale, exhibition and export purposes, 9,331 serum samples were submitted to the serum agglutination test. Positive reactions were given by 955, and 495 gave doubtful reactions.

The voluntary Brucellosis-free Herd Scheme was continued. Five herds were accredited.

Brucellosis (Sheep)

There was evidence of *Brucella ovis* infection in many widely separated flocks. Mainly British breeds were involved, though Merinos were also affected. Diagnosis was based on clinical examination and the complement fixation test, while in some cases semen was examined for the organism. The disease did not cause significant infertility, except in a few flocks. There was an increasing number of positive reactions in flocks wherein there was no clinical evidence of epididymitis caused by this disease; possibly because owners had become most aware of the effect of the infection, and culled clinical cases.

In one stud, serum samples from eleven of twenty-four rams returned positive reactions though there was no clinical case. However, *Brucella ovis* was recovered from the semen of the rams. In contrast, in another flock seventy-eight of ninety-four rams showed clinical evidence of the disease although lambing performance had been comparable with the district average.

In all, 3,276 serum samples were submitted to complement fixation test for diagnosis, sale, exhibition, and export purposes; 128 were positive and 63 doubtful.

Leptospirosis (Cattle and Pigs)

Leptospirosis was an important cause of abortion in cattle though less so than brucellosis. There were some mortalities in calves due to the septicæmic form.

In pigs, *Leptospira pomona* was the most important diagnosed caused of abortion and prenatal losses though, in many problems of this type, the cause was not determined.

In the southwest, the first cases of leptospirosis in pigs since 1959 were encountered on two properties. The pigs reacted positive to the agglutination test for *Leptospira pomona*, following reports of abortions and early deaths in piglets. Seemingly there had been no recent introduction of pigs to these properties, and in both cases the abortions suddenly occurred after a long period of good health.

Mastitis

Officers in dairying districts spent a lot of time investigating mastitis problems. Staphylococci were the cause in most herds investigated, and attention was mostly drawn to the problem by failure of antibiotics to bring the disease under control. Defective milking machines contributed in many cases.

Resistance of staphylococci to many antibiotics was demonstrated, as shown in the Research Section of this Report.

Klebsiella sp. was the cause of outbreaks of the acute form of the disease which appeared suddenly in two herds after prolonged freedom from mastitis. One outbreak due to *Aerobacter* sp. was encountered.

The California Mastitis Test was widely used to assess the extent of infection in problem herds. In one herd, 90 per cent of milking cows returned strong positive reactions to the test.

In a survey of fifty-three Illawarra herds, 25 per cent of quarters were positive to the California Mastitis Test. In cultured milk samples from ten of these herds, staphylococci were in 53 per cent and streptococci in 16 per cent of samples. Resistance was demonstrated by 86 per cent of staphylococci to penicillin, by 38 per cent to streptomycin and by 24 per cent to ampicillin.

The planned Mastitis Control Programme has been started. Forty herds throughout the State will be selected for demonstration purposes. Near to thirty of these are now operating. The first phase of the programme designed to extend over two years is to provide data basic to a farmer educational programme. It is to gather information on mastitis incidence, mastitis effect on production, and the economic benefit of control measures. Control is based on a system of sanitation, use of strip cup for diagnosis, treatment of clinical cases, regular use of the California Mastitis Test, bacteriological examination of reactors' milk, checking on milking machine efficiency, and dry cow therapy.

One case of prolonged excretion time of penicillin was encountered. Milk from an animal which had received a single treatment with penicillin in each of 2 quarters was rejected by a milk depot for 31 days, because of positive results to the Keogh test. The cow had only mild mastitis and never previously been treated for this disease.

Internal Parasites (Sheep)

This was a moderate year for worm infection. Infections were generally light in the spring months but incidence and severity did increase for the remainder of the year. In the first half of the year, the predominating species were *Ostertagia*, *Trichostrongylus*, *Nematodirus*, *Cooperia*, *Dictyocaulus* and *Chabertia*. For the remainder of the year, *Nematodirus*, *Ostertagia*, *Moniezia*, *Haemonchus* and *Oestophagostomum* spp. predominated.

On the southern tablelands, there was a marked upsurge in worm infection of weaner sheep in mid-summer. *Nematodirus* and *Ostertagia* were the parasites concerned. Coccidiosis also appeared, as a complicator.

In the autumn, infection with *Haemonchus contortus* reached high levels on the northern tablelands. There were some heavy losses. On the southern tablelands, an increasing number of owners availed themselves of a commercial, faecal egg-counting service—to indicate level of infection as a basis for planned anthelmintic treatments. In the far west, where worms are not normally serious, *Nematodirus* became a problem on some properties in the autumn.

Observations were made on an additional property where there was *Haemonchus contortus* resistance to thiabendazole. Sheep continued to show clinical evidence of infection after being drenched 18 days previously with the drug at higher than the recommended dose. Two sheep experimentally treated with thiabendazole showed no reduction in faecal egg-count 4 days later.

Infection with immature paramphistomes caused considerable ill-health and some losses on a northern tablelands property which includes a lot of poorly drained land. Shortage of pasture, forcing the sheep to graze the wet areas, precipitated the infection.

Internal Parasites (Cattle)

Ostertagia spp. were the most important. Young stock were predominantly involved but there were some cases in adult animals. Repeated drenching with broad spectrum anthelmintics was needed in cases of Type II infection.

Haemonchus placei was also an important parasite in the northern parts of the State. Other species encountered were *Cooperia*, *Oestophagostomum* and *Trichostrongylus*. Some losses were also caused by the flukes *Fasciola hepatica* and *Paramphistomum* spp. In the latter case immature parasites were responsible.

Neoscaris vitulorum, only previously recorded in cattle in Australia on three occasions, was found infecting calves on a property on the far north coast. Faecal egg-counts detected up to 8,600 eggs per gramme. The infection led to death of two calves 6 to 8 weeks old.

Nematodirus spp., rarely found in calves in New South Wales, were encountered in calves in two widely separated herds on the north coast. In one case, the species was *N. helvetianus*.

Infectious Laryngotracheitis (Poultry)

Because of the widespread distribution of infectious laryngotracheitis in the Tamworth area, all restrictions on the entry of poultry into that area were removed. The restrictions had been designed to prevent introduction of the disease. Most outbreaks were in fact in that area, largely because of widespread preventive vaccination in the parts of the State where the disease has long been enzootic.

Many of the outbreaks were of the acute haemorrhagic form, with up to 7 per cent mortality and 75 per cent morbidity.

Haemorrhagic Syndrome in Cattle

A haemorrhagic syndrome of unknown aetiology affected cattle which, because of drought, had been placed on agistment in the northwest. The losses were in the late winter and early spring. Some cases started shortly after cattle had been returned to the original property from agistment, but others occurred on the agistment holdings. There were some heavy losses. The most serious was the death of 100 stud Hereford cows in a herd of 145. There was evidence that stress, such as caused by mustering or travelling, precipitated losses.

Salient lesions comprised haemorrhages in connective tissue, subserous tissue and the intestinal tract. All degrees of haemorrhage from petechiation through ecchymoses to frank

massive haemorrhages were noted. In some of the early cases investigated the cattle had grazed land infested with rock fern (*Cheilanthes tenuifolia*) and losses were attributed to poisoning by this plant, but cases were later encountered where cattle did not have access to this species or other toxic plants.

Arthritis (Sheep)

Polyarthritides in sheep, caused by a virus of the psittacosis-lymphogranuloma-venereum group, was first encountered about 15 years ago near Gilgandra in the northwest. It has continued to spread and occurred this year over a wide area of the State.

The disease primarily affected lambs. There was high morbidity, with occasional deaths. Prime lambs suffered severe growth check. The disease tended to predominate in British breeds though there was an increasing incidence in Merinos. Penicillin was as effective as broad spectrum antibiotics in promoting recovery.

Histophilus ovis was found to be the cause of an outbreak of polyarthritis in crossbred lambs 5 to 6 months old. About 100 of 700 were affected. Recovery in many cases was only after prolonged and debilitating illness. The organism was cultured at the District Veterinary Laboratory, Armidale, from affected joints and the disease was reproduced by inoculation of the organism into normal lambs. Characteristic pathological features were serositis, arthritis and tendovaginitis. Synovial fluid was excessive, and obviously cloudy, but not purulent. Periarticular tissues were thickened, oedematous and congested. The organism was recovered from the joints most severely affected in the experimental animals.

Black Disease

Nine outbreaks were investigated; four in sheep, four in cattle, and one which caused death of a pig. Preventive vaccination of sheep was widely done in areas where the disease is enzootic, but far less so in cattle.

The pig incidence was that of a sow in a group of ten on a property in the southwest. Symptoms were anorexia and laboured breathing, followed by death some hours later. On necropsy a typical hepatic lesion was found, and *Clostridium* sp. was seen on histopathological examination. In sheep and cattle, the liver damage preceding onset of the disease is caused by larvae of *Fasciola hepatica*. Pigs on the property where the case occurred did not have access to any area from which they could have acquired this parasite, so migrating larvae of *Ascaris suum* are thought to have initiated the disease.

Fowl Cholera

Four outbreaks were investigated; two in fowls and two in turkeys. One mortality in turkeys, with *Salmonella singapore* concurrent, was very heavy. Sulphaquinoxine was usually found successful.

Enteritis (Sheep)

Many outbreaks of a type of diarrhoea which has come to be known as "sulpha responsive scours" were investigated in sheep throughout the tablelands. Cause was not determined. Worm infection and coccidiosis were eliminated as possible causes. Response to sulphadimidine administration was dramatic. Many outbreaks followed treatment for worm infection. Any direct relationship with anthelmintic administration was not determined. Symptoms were like those of worm infection and led many owners to believe that the worm therapy had been unsuccessful. Up to 45 per cent of mobs of sheep were clinically affected, but mortality was generally light. A characteristic necropsy finding was haemorrhagic colitis and typhilitis, with the mucosa swollen to give a cobblestone appearance.

In the spring, sudden death of sheep occurred on many properties in the south west, from a syndrome characterized by marked haemorrhagic enteritis and rapid post-mortem carcass decomposition. Cause was not determined.

Bracken Fern Poisoning

Eleven outbreaks in sheep and cattle were investigated. In most, the stock ate bracken because of a pasture shortage. But in one case, over-succulent pasture appeared to have led to the excessive ingestion of bracken.

Death of 56 per cent of a mob of cattle occurred on one property where the animals were constantly rotated between a paddock of grazing oats and paddocks where there was bracken. In previous years when the cattle had been set-stocked on the bracken country, no loss had occurred. Deaths took place up to 12 weeks after removal from the bracken.

Epididymitis (Sheep)

Most cases of epididymitis in rams were caused by *Brucella ovis*, referred to earlier in this Report. But there were also flock infections caused by *Actinobacillus seminis* and *Actinobacillus lignieresii*.

In one flock, epididymitis and orchitis was caused by *Histophilus ovis*. Five of seventy-five rams aged 5 to 8 months were affected. In the early acute stage, the rams were sick and the affected testes hot and painful.

Enzootic Ataxia (Sheep)

A syndrome of progressive ataxia in a Merino flock, involving each year for several years some 2 per cent of sheep aged 9 to 18 months, has been found to be due to enzootic ataxia. Pathognomonic lesions were in the brain stem and spinal cord. Liver copper levels were normal but, it is postulated, could have returned to normal after onset of the pathological processes.

Oedema Syndrome (Turkeys)

In a disorder affecting young turkey poults in the Tamworth District, the main features were infiltration of the subcutaneous tissues—particularly of the abdomen—with clear straw-coloured fluid which extended in places between the muscle bundles. Lungs were also markedly oedematous. Histopathological examination showed degenerative changes in the liver and tubular degeneration and early necrosis in kidneys. Birds 1 to 6 weeks of age were affected. Peak losses were between 1 and 3 weeks of age and mortalities were 3 to 4 per cent. Cause was not determined.

Facial Eczema

Two outbreaks occurred, one in March and the other in June. Losses were not heavy. In one case there was an average count of 52,000 spores of *Pithomyces chartarum* per gramme of pasture.

Bone Fragility (Polwarth Lambs)

A bone fragility syndrome in Polwarth lambs, previously investigated on a southwest slopes property in 1964, recurred on the same holding. It was characterized by high susceptibility to fractures, was confined to lambs grazing an oat crop, and did not occur in a separate group of lambs kept on a barley crop. The weather prevailing during the months preceding both the 1964 and the 1968 outbreak featured general lack of sunlight, with unusually long periods of cloudy weather. This suggested possible involvement of vitamin D deficiency, but there was no incidence in lambs grazing oats on neighbouring properties.

Cerebral Habroneniasis (Horses)

On a property in the far west, infection of brain tissue with *Habronema microstoma* caused the deaths of three horses out of ten, and there were symptoms in two more. Affected animals showed chronic wasting and some ataxia.

MISCELLANEOUS ACTIVITIES BY VETERINARY PERSONNEL

Services for Government Farms

Departmental veterinary officers provided a clinical and disease control service for livestock at Government farms; 221 such services. The work included testing for disease, diagnosis, treatment, vaccination, surgery, post-mortem examinations and pregnancy determinations.

Training of Officers

Seventeen veterinary officers and five veterinary inspectors attended a course in avian diseases conducted by the Post-Graduate Committee in Veterinary Science. Two veterinary officers also attended a course in equine practice organized by the same committee.

A system of stationing newly appointed veterinary inspectors with an experienced veterinary inspector for a month to gain experience has been initiated.

Three schools of instruction were held to brief participating officers on details of the Mastitis Control Programme.

Preparations Against Exotic Disease

The comprehensive plan for overcoming a possible outbreak of foot and mouth disease was finalized, and agreed to by veterinary authorities in other States and in the Commonwealth Department of Health. Steps were taken to familiarize with their duties and functions in an outbreak all staff and others who would be involved. A senior veterinary officer attended with representatives from other States a training course in exotic diseases conducted by the New Zealand Department of Agriculture. A theoretical exercise in the eradication of foot and mouth disease was provided for veterinary inspectors who dealt with two hypothetical outbreaks.

An investigation was commenced in association with the Division of Dairying to formulate a plan for the safe disposal of milk during an outbreak.

Artificial Insemination

New regulations governing precautions to be taken to prevent disease in bulls being used for artificial insemination were gazetted. All bulls proceeding to artificial insemination centres were first tested for genital and other diseases at the Veterinary Research Station, Glenfield. The testing involved mating with virgin heifers, examination of material for bacteriological and protozoal infections and serological testing. Thirteen bulls were so tested this year. All were found free of disease.

All bulls at the State's two artificial insemination centres were tested for tuberculosis, brucellosis, leptospirosis and pleuropneumonia and, as a precaution, were treated with antibiotics for vibriosis.

Rabbit Myxoma Virus

Demand for supply of virus from the Veterinary Research Station, Glenfield, increased. The requests totalled 773, as against 468 in the previous year. Some 128,380 doses of virus were distributed in New South Wales and 13,520 were supplied to other States.

This was the greatest demand since initial release of the virus in 1951. The increase was probably associated with introduction of a method of formulating the virus to permit intraocular installation instead of hypodermic injection.

Vaccine Testing

At the Veterinary Research Station, Glenfield, samples of commercial vaccines are annually checked for sterility and safety, and also for efficiency in the case of vaccines against anthrax, contagious ecthyma, fowl pox and infectious laryngotracheitis. This year forty samples of vaccine were examined. All were satisfactory except a sample of *Brucella abortus* vaccine.

Laboratory Diagnostic Services

The following table shows the totals of consignments of specimens received at the Veterinary Research Station, Glenfield, the Colin Blumer District Veterinary Laboratory, Armidale, and the District Veterinary Laboratory, Wollongbar. This was the first fully operative year for the District Veterinary Laboratory, Wollongbar.

Class of animal	Glenfield	Armidale	Wollongbar
Cattle	3,259	795	918
Sheep	1,556	343	..
Poultry	838	119	..
Pigs	601	106	272
Horses	60	..	..
Other animals	285	28	70
Plants	129	..	..
Miscellaneous	150	18	..
Totals	6,878	1,409	1,260

The next tabulation indicates the source of diagnostic material received at the three laboratories:

Submission from	Glenfield	Armidale	Wollongbar
Departmental officers	2,257	246	390
Veterinary inspectors	1,783	608	352
Veterinary practitioners	2,371	520	462
Other Professional Groups	..	32	56
Others	477	3	..
Totals	6,888	1,409	1,260

Identification of Sale Cattle

Plans were finalized to introduce during the following year a system of compulsory identification of cattle being offered for sale. The main purpose is to be able to ascertain the source of cattle whose carcasses at abattoirs are found infected with disease.

A form of plastic tail tag, yellow, with an identification number in black indicating ownership, was approved. Regulations were gazetted under the Stock Diseases Act to provide implementation of the scheme and to permit certain exemptions.

EXTENSION SERVICE BY VETERINARY PERSONNEL

Individual Contacts, and Mass and Group Media

Considerable extension was done on personal contact by veterinary officers and veterinary inspectors, and by group and mass media. Some sixty-six sessions were conducted at schools and meetings organized with primary producer bodies, mostly the Agricultural Bureau. Demonstrations were given at twelve field days. Five telecasts and fifty-five radio broadcasts were made. Animal health displays were set up at four Agricultural Shows. Demonstrations by means of closed circuit colour television were given at four centres.

Officers had planned extension programmes, based on major problems in their districts. Subjects selected for programmed extension were: Control of clostridial diseases in sheep and cattle; Control of sheep footrot; Control of cattle lice; Control of mastitis; Control of brucellosis in cattle; Control of mineral imbalance in sheep and cattle; Prevention of pregnancy toxæmia; Control of the toxic plant *Heliotropium europæum*; Prevention of losses in baby pigs; and Promotion of pregnancy diagnosis in beef cattle.

Publications

Three issues of the publication "Veterinary Notes" were produced and distributed to official veterinary personnel and veterinarians outside the Department serving the State's livestock industries. Issues of the Livestock Health and Husbandry Report for the years 1966-67 and 1967-68 covering the work of the Division of Animal Industry were prepared.

Prosecutions

Stock Diseases Act.—Seventeen prosecutions, of which sixteen were successful, were undertaken under the Stock Diseases Act or its regulations. Most common offences were attempts to sell lice-infested sheep, failure to report presence of lice in sheep, transporting pigs without permit, and transporting cattle into pleuropneumonia protected areas without permit.

Swine Branding Act.—Two successful prosecutions under the Swine Branding Act were undertaken.

Veterinary Surgeons' Act

Visiting cards and letterheads were collected from practising veterinarians to determine whether regulations under the Veterinary Surgeons' Act were being adhered to. Several minor breaches of the advertising regulations were dealt with by warning. A suspected case of professional misconduct was reported to the Veterinary Surgeons' Board.

Stock Foods and Medicines Act

Stock Foods.—Applications for registration of stock foods that were approved totalled 2,219; 5 per cent more than those approved in the previous year. Registration was refused for some stock feeds which contained antibiotics in excess of those permitted by new regulations to the Poisons Act.

Many stock feed manufacturing premises were inspected. A number of stock feed samples were submitted to the Division of Science Services for analysis but no case of gross deficiency was detected.

Stock Medicines.—The Stock Medicines Board dealt with 1,616 annual applications for re-registration and 183 applications for registration of new products. All were approved except two rejected, two voluntarily withdrawn and 161 not finalized at the end of the year under Report.

The Board maintained liaison with the Commonwealth Sub-Committee on Veterinary Chemicals which provided information for appraising the efficiency and safety of drugs being considered for registration. Liaison was also maintained with the Department of Public Health in relation to the Poisons Act and its regulations.

Applicants for registration were encouraged to recommend dose rates in the metric system.

Cattle Compensation Act

Claims Approved.—Claims approved for payment totalled 7,626; as against 6,936 in the previous year. The greater total resulted largely from the 1,111 increase in claims because of cancer. Claims because of tuberculosis were less than in the previous year, by 205. Statistics of claims for the various diseases were as follows:

Disease	Claims	Animals
Tuberculosis	481	1,179
Cancer	4,330	5,879
Actinomycosis	2,168	2,547
Actinobacillosis	635	792
Pleuropneumonia contagiosa*	2	2
Trichomoniasis	2	14
Tick fever	4	14
John's disease	4	4
Vibriosis	Nil	Nil
Totals	7,626	10,431

* Found free of the disease on post-mortem examination.

Claims Disallowed.—Claims for which compensation was disallowed were as follows: 113 for delayed notification by owners; forty-five for failure to notify disease; twenty-four for failure to pay levy or submit return; and six for delayed application for compensation; total 188.

Also, in sixty-two cases the amount of compensation payable was reduced. These were cases where the claim had not been submitted within sixty days of slaughter of the cattle.

Board of Tick Control—Cattle Tick Control

STAFF

At the start of the year, inspectorial staff numbered 511, but by the end of the year the number employed had fallen to 501. No difficulty was experienced in filling vacancies that occurred.

CATTLE TICK ERADICATION MEASURES

The Situation in Various Areas

Barcoongere Quarantine Line.—This newly established line was severely damaged by bush fires and was breached by several horses and cattle. This necessitated extension of the leases over the severed areas—kept empty of stock since April, 1968. Construction of a new buffer fence, 5 chains from the existing fence, was commenced along this line. By the end of the year, 11 miles had been completed. The fence will greatly strengthen the line, designed to become the boundary of the Grafton Quarantine Area.

Rocky River Quarantine Area.—This area, 12 acres in clean country adjoining the Tabulam external quarantine boundary, was gazetted because of the breakthrough of a beast out of the Tabulam Area. No tick was found on this animal, nor on stock on the property of origin.

Murphy's Quarantine Area.—This area, south of the Copmanhurst Area, was also gazetted because of a breakthrough to clean country—this one by a horse. Stock in the area were examined at three week intervals during the spring, summer and autumn. No cattle tick was detected and, since the risk of spread of ticks to the area had always been remote, quarantine was lifted at the end of the year.

CATTLE TICK CONTROL POLICIES

The Situation in Various Areas

Areas East of the Richmond Range.—Stock in the Richmond, Kyogle and Tweed Areas were given six dippings at 21-day intervals between October, 1968, and February, 1969. About 510,000 head of cattle were treated on each occasion. Dipping of all calves over the age of 4 weeks was again

enforced. Some difficulty was experienced in moving young calves to and from dips, especially along roads carrying an ever increasing volume of vehicular traffic.

Heat waves and below average rainfall presented a problem, particularly in the Kyogle and Tweed Areas. For very poor cattle examinations for ticks were permitted instead of dipping.

The following table shows that number of infestations recorded decreased in 1968-69. The new policy for infested holdings presented no difficulty and appeared to bring about improved control. Most of the problem herds that had been undergoing intensive treatment during 1967-68 remained clean. The decision to alter the policy, to make it mandatory to carry out examinations on holdings adjoining those infested, proved of value late in the year—in detecting light infestations that might otherwise have gone undetected.

Area	Number of infestations detected				
	1964-65	1965-66	1966-67	1967-68	1968-69
Richmond Area					
Bangalow Section	35	2	3	18	4
Lismore Section	75	9	2	3	1
Nimbin Section	20	8	7	10	
Casino Section	108	20	12	14	1
Rapville Section	3			1	
Kyogle Area	53	5	3	7	11
Tweed Area	33	3		1	4
Totals	327	47	27	54	21

Areas West of the Richmond Range.—Four treatments were intended, commencing in February. But the fourth treatment was cancelled because of adverse season. About 140,000 head of cattle were dipped on each occasion. Stock being moved had to be examined and dipped before starting the journey.

The total of infestations increased; twenty-three recorded, as against twelve in 1967-68. Most were in the Bonalbo and Cullendore Areas. Some were detected when stock were examined on properties adjoining those whereon cattle tick had been found. These probably would have remained hidden but for the examination.

Examination of some 7,280 head of cattle to determine the status of that portion of the Cullendore Area west of the Northwest Rivertree Quarantine Line revealed six single tick infestations. Therefore no further immediate progress could be made towards releasing this section from quarantine. The Northwest Rivertree Quarantine Line was cancelled and since two of the infestations involved country adjoining the clean country boundary, mobile inspection teams were placed in clean country south of the Cullendore Quarantine Area.

All clean country holdings adjoining the Cullendore Quarantine boundary were examined twice. No cattle tick was found, but, since some of these examinations were in the late autumn, it was decided that further examinations should be made next summer and autumn before classing the country as free from cattle tick.

Statistics of infestations are shown in the following table:

Area	Number of infestations detected				
	1964-65	1965-66	1966-67	1967-68	1968-69
Bonalbo	3	1	2	9	16
Tabulam	2	11	5	2	1
Woodenbong	13	2	7		
Cullendore				1	6
Totals	18	14	14	12	23

Grafton and Copmanhurst Areas.—The policy of examining moving stock was continued. Also, stock on the Woodford Island property in the Grafton Area—where an infestation was detected last year—were examined at 21-day intervals. No further evidence of cattle tick was found and the holding was released from quarantine.

In March, 1969 a light cattle tick infestation was detected at Fine Flower in the Copmanhurst Area. The infested property adjoining one found infested in 1967—released from quarantine after the cattle had been examined every 3 weeks for 12 months. Adjoining holdings were examined and no further evidence of ticks detected.

Only a few voluntary treatments were undertaken in the Copmanhurst Area, mostly in the spring. They were aimed mainly at combating lice.

The Policy for Infested Properties

The existing policy for infested holdings both east and west of the Richmond Range, introduced late in 1967, appeared to be effective in bringing about improved control. Outside the period of policy dippings, all stock on holdings adjoining those found infested were examined four times at 21-day intervals.

Adoption of this practice late in the year in the Bonalbo District resulted in detection of infestations on two holdings, but only after completion of the second examination. The 1967-68 findings that the minimum period of 21 weeks quarantine for an infested holding meant fewer re-infestations, was supported by the 1968-69 results. Not one such property became re-infested after the stock had undergone the required treatments and examinations.

Acaricide Resistance in Ticks

Investigations into suspected acaricide resistance in ticks near Clunes (Bangalow Section), started in the previous year, confirmed the presence of organo-phosphate resistance of the *Biarra* type in a small percentage of the cattle ticks tested. This resulted in establishment of a special quarantine area at Clunes.

The development was viewed with concern. It led to the disturbing thought that resistant ticks might be more widespread, presenting a threat not only to cattle within the Tick Quarantine Areas but also clean country.

Origin of the resistant ticks did not seem associated with any introduction from Queensland. Development by mutation is a possibility. Occurrence of the resistance had long been feared and had emphasized need for greater concentration on ticks in problem areas.

Staff were alerted to the possibility of resistant strains of ticks appearing in some of the problem areas. It was made a practice, where heavy infestations were detected, for samples of cattle ticks to be forwarded to Dr Wharton of the CSIRO, Brisbane, to be tested for organophosphorus resistance. This year engorged female ticks were collected from ten properties, but no other evidence of resistance was detected. The assistance by the CSIRO has been greatly appreciated.

Following detection of the resistant ticks, all stock moving out of the Clunes Area received three dippings in dursban. Stock travelling through the area were also required to undergo a cleansing treatment in dursban.

Resistant ticks of the *Biarra* type were also found in the Currumbin Valley, Queensland, comprising a threat to stock-owners on the N.S.W. side of the border. In co-operation with the Queensland Department of Primary Industries, the dipping facilities in the Currumbin Valley and the feasibility of implementing a dipping programme to prevent the spread of ticks across the border were studied.

The Queensland Border from the Tweed to the Woodenbong Area, has been surveyed to find danger spots requiring attention. As a result, steps were taken to widen to 5 chains the buffer area along 5 miles of the border in the Tweed Area. The buffer was widened also in the Kyogle and Woodenbong Areas.

GRAFTON TICK ECOLOGY SITE CLOSED DOWN

This site at the Grafton Agricultural Research Station has been closed down, after studies on cattle tick ecology during three winters.

On previous years' findings, larvae from the August exposures were expected to dwindle to nil by the end of December, 1968. Even so, the site was not declared clean until after bait calves had been run on the site for a fortnight during February, 1969. Over and above that, restrictions were maintained until the end of June, 1969.

INSPECTION OF STOCK AT ABATTOIRS

Examinations were continued at Grafton, Macksville, Tenterfield, Casino and Byron Bay Abattoirs. *Haemaphysalis longicornis* and *Ixodes holocyclus* were found at Macksville and Grafton Abattoirs, on cattle from clean country. No evidence of tick life was detected at Tenterfield.

The Assistant Inspector at Tenterfield Abattoir continued to supervise the unloading of cattle arriving from Queensland, and the dipping of all ex-Queensland calves before slaughter.

At the Casino and Byron Bay Abattoirs, the Assistant Inspectors continued to examine cattle presented for slaughter, but little tick life was found. The staff there supervised the slaughter of cattle from tick fever holdings and of cattle from clean country.

INSPECTIONS IN CLEAN COUNTRY

Mobile inspection teams operated in the autumn, south of the Grafton area and adjoining the Cullendore Quarantine Area. No cattle tick was found.

TICK FEVER

The optimistic outlook at 30th June, 1968, was maintained by the events of the next 6 months, but early in 1969 the detection of tick fever on five properties caused concern. On four of the holdings, one or more clinical cases occurred while the fifth involved the detection of carriers on an adjoining property. All infections were caused by *Babesia argentina*.

There was no evidence of cattle tick in any of the outbreaks. This and other factors led to a decision to reduce quarantine of tick fever holdings to ten months. Four holdings that had been undergoing quarantine during 1967-68 were released without a further case being detected. It is interesting that even on the one property in the Bangalow Section, where there was an associated heavy infestation of cattle ticks, and where engorged female ticks proved infective upon examination of haemolymph, there was no further case of tick fever.

Complement fixation testing was almost entirely confined to infected and adjoining holdings. However, testing did involve Queensland cattle approved for introduction, illegally introduced cattle, and certain other tick infested cattle. No carrier was detected apart from those previously referred to. Total cattle tested numbered 6,600.

The following table shows the number of properties and stock quarantined for tick fever:

Area	1965-66		1966-67		1967-68		1968-69	
	Hldgs	Stock	Hldgs	Stock	Hldgs	Stock	Hldgs	Stock
Kyogle	19	2,510	10	1,042	1	114	..	..
Tweed	4	412	11	1,155	2	213	..	..
Richmond	1	92	..	..	1	73	2	117
Woodenbong	..	..	..	204	1	701	1	271
Legume	..	..	..	..	2	135	..	..
Bonalbo	..	..	1	104	..	..	2	611
Totals	24	3,014	23	2,505	7	1,236	5	999

DIP ACARICIDE CONVERSIONS

The policy of converting dips from delnav to ethion was pursued but on a much reduced scale. Where dips had to be recharged, ethion was used. As at 30th June, 1969, there were 751 dips charged with delnav, 592 with ethion, fifteen with dursban and three with sevin.

ACARICIDE TOXICITY

Overall, losses of stock following dipping were again negligible—and fairly evenly distributed between ethion and delnav. As in previous years, there was a high rate of recovery after early treatment of affected animals. Mortalities wherein a diagnosis of organo-phosphate poisoning could be firmly established were mainly in calves. Many of these appeared associated with stress—overheating, hunger and thirst; particularly noticeable after sales.

Neither dursban, under trial in several dips, nor sevin presented toxicity problems.

Hair dunking tests to determine the extent of acaricide deposited in the hair of cattle were continued, for all dips. Corrective action was taken when deposits reached too high a level. By this means, mortalities from organo-phosphate poisoning were minimised.

COMPENSATION

Compensation claims were paid for loss of 219 head of stock by death or injury, and involving \$10,015.92.

FENCING, DIP AND BUILDING CONSTRUCTION

Fencing.—Some 40 miles of new quarantine boundary fencing was erected, and major repairs were undertaken on 30 miles of existing fences. The new fencing included 11 miles of buffer fence on the southern boundary of the Grafton Area and 9 miles of buffer fence on the Queensland Border, where there was danger of introduction of ticks from Queensland. Three miles of new buffer fence was also erected around the Cattle Tick Research Station, Wollongbar, to reduce the chance of ticks spreading to adjoining holdings.

Dips.—Due to the extremely dry conditions, a number of the dips developed serious leaks—causing twelve to require considerable reconstruction. Because of this additional work, only four new dips were built. Three of these were needed to replace dips in an area that formed part of the catchment of a new town water supply. Repairs were done to 338 dips while 107 dip yards were gravelled.

Accommodation.—Two new cottages, twelve prefabricated huts and four tent units were constructed, and eleven cottages, three huts and five tent units were repaired. The shelter at Tweed Heads gate was completed and new accommodation provided for gatekeepers at this and another gate. Extensions to the Board's laboratory were started.

Queensland Border Control

INSPECTORIAL STAFF

Sixty-eight inspectors were full-time employed to control the introduction of stock from Queensland, and twelve part-time.

STOCK MOVEMENTS

There was a big increase in stock movements in comparison with the previous year; due mainly to drought effect in Queensland. Features of the movements were lesser totals in the various mobs, compared with past years, and increasing use of motor transport for stock. The following tables show the totals of various types of stock which moved across the border between New South Wales and Queensland.

From Queensland to New South Wales

Administrative section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	155,817	30,963	36,169	1,786	61
Goondiwindi	352,071	1,158,698	445	8,471	626
West of Mungindi	71,262	1,724,918	..	2,559	2,302
Tibooburra	6,769	9,272	..	..	..
Totals	585,919	2,923,851	36,614	12,816	2,989

From New South Wales to Queensland

Administrative section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	21,925	357,675	357	1,468	8
Goondiwindi	85,989	798,727	1,782	1,832	3
West of Mungindi	2,069	53,392	..	..	..
Tibooburra	71	..	..	..	..
Totals	110,054	1,200,794	2,139	3,686	11

CONSTRUCTIONAL WORK AT THE BORDER

Some 187 chains of new replacement fencing were erected, at several sites where the board fence had deteriorated. A length of 113 chains of fencing was erected where a realignment took place, with part of the cost borne by a landholder. Considerable fence repair work was needed in a section damaged by a cyclone.

The Department bore the installation cost of a concrete culvert under a Queensland road adjoining the border, to prevent the entry into New South Wales of water which could carry eggs or larvae of the cattle tick. Two new stock-holding yards and loading ramps were erected. Renovations and replacements were effected to sixteen staff cottages and five offices.

Meat Inspection Service

STAFF

At 30th June, 1969, the staff of the Meat Inspection Service comprised: the Principal Veterinary Officer (Meat Inspection), the Assistant Principal Veterinary Officer (Meat Inspection), a veterinary officer, two typists, a supervising Senior Meat Inspector, 216 meat inspectors, including seniors and one vacancy, twenty brand boys and three vacancies.

ACTIVITIES OF THE MEAT INSPECTION SERVICE

Ante and Post Mortem Inspections

Cattle were inspected at Homebush Saleyards on three days weekly and pigs once weekly. All cattle were inspected on receipt at Homebush Bay Abattoir, and at all works all animals were inspected shortly before slaughter.

Post mortem inspection was done at the time of slaughter at the State Abattoir, Homebush Bay, Riverstone Meat Works, Riverstone, two small licensed meatworks in the metropolitan area, and at the following country centres: Aberdeen, Berrima, Blayney, Byron Bay, Casino, Dorrigo, Dubbo, Forbes, Goulburn, Guyra, Gunnedah, South Grafton, Inverell, Moree, Mudgee, Macksville, Orange, Tenterfield, Wagga Wagga, Wallangarra, Wingham, and Yanco. Horse carcasses were inspected at one pet-food knackerie.

All meat introduced into the Metropolitan Abattoir Area was reinspected, and the handling of meat at the Metropolitan Markets was supervised for sanitation. Smallgoods factories were inspected.

Total Slaughtering at Abattoirs where State Inspectors are Located

	Cattle	Calves	Pigs	Sheep
State abattoir	94,514	66,726	180,137	2,266,728
Inside County of Cumberland*	10,915	24,862	35,580	574,524
Country areas*	479,140	181,687	566,115	4,476,501
Totals	584,569	273,275	781,832	7,317,753

* Excludes carcasses for export overseas. For export the slaughtering comprised 21,152 cattle inside County of Cumberland and 178,858 in country areas; 4,638 calves inside County of Cumberland and 31,079 in country areas; 776 pigs inside County of Cumberland and 3,505 in country areas; 238,477 sheep inside County of Cumberland and 1,687,685 in country areas.

Entire Kill.—784,579 cattle; 308,992 calves; 786,113 pigs; 9,243,865 sheep. Also, 4,262 horses and three cattle were slaughtered at knackeries.

Total and Partial Carcass Condemnations

The number of carcasses totally condemned were: cattle 2,024, calves 1,092, pigs 3,764, and sheep 24,514. Carcasses partially condemned were: cattle 25,732, calves 140, pigs 17,089, and sheep 37,577. The following two tables show the percentages of the entire kill that were totally or partially condemned, and relates these to the conditions causing the condemnations:

Total Condemnations

Reason	Cattle %	Calves %	Pigs %	Sheep %
Actinomycosis }	0.002	..	..	..
Actinobacillosis }	0.013	0.041	0.320	0.044
Arthritis	..	..	..	0.021
Caseous lymphadenitis	..	..	..	0.009
Cysticercus ovis	0.067	0.010	0.009	0.112
Emaciation	0.001	..	..	0.013
Sarcosporidiosis	0.028	0.014	0.063	0.006
Septic conditions	0.023	0.001	0.018	..
Tuberculosis	0.023	0.001	0.018	..
Other conditions	0.123	0.288	0.068	0.060
Totals	0.257	0.354	0.478	0.265

Partial Condemnations

Reason	Cattle %	Calves %	Pigs %	Sheep %
Actinomycosis }	1.889	0.002	..	..
Actinobacillosis }	0.266	0.015	0.746	0.142
Arthritis	..	..	..	0.202
Caseous lymphadenitis	..	..	..	0.001
Sarcosporidiosis	0.021	0.001	0.044	0.006
Septic conditions	0.017	..	0.038	..
Tuberculosis	1.086	0.028	1.346	0.057
Other conditions	..	..	..	..
Totals	3.279	0.045	2.174	0.408

Inspection of Meat Introduced into the Metropolitan Abattoir Area

The quantities of meat inspected after introduction into the Metropolitan Abattoir Area were as follows:

From Within New South Wales.—Beef—carcasses 365,028, piece meats 7,646,203 lb; Veal—carcasses 174,112, piece meats 207,647 lb; Pork—carcasses 450,995, piece meats 1,470,040 lb; Mutton—carcasses 3,845,278, piece meats 843,498 lb; Sundries—12,572,626 lb.

From Outside New South Wales.—Beef—carcasses 105,861, piece meats 8,333,106 lb; Veal—carcasses 98,130, piece meats 554,748 lb; Pork—carcasses 76,036, piece meats 5,695,803 lb; Mutton—carcasses 120,237, piece meats 882,305 lb; Bacon—carcasses nil, piece meats 2,786,806 lb; Sundries—795,367 lb.

Service under Commonwealth Quarantine Act

The Division of Animal Industry continued to administer certain sections of the Quarantine Act 1908–1969 for the Commonwealth Government. Two Veterinary Officers, one Senior Port Inspector, and nine Port Inspectors now do the quarantine work at Sydney and Port Kembla. The District Veterinary Officer and one Port Inspector do the work at Newcastle.

IMPORT INSPECTIONS

Animal Imports

Total prohibition remained on importation of sheep, goats, and pigs into Australia. The embargo on cattle from New Zealand was lifted and the first consignment arrived in March, 1969.

Imports of permitted animals were comparable to the previous year. There were slight increases in dog and queen bee totals and small decreases in horse, birds, and zoo and "scientific" animal totals.

The first consignment of cattle semen from the United Kingdom since the lifting of the embargo arrived during April, 1969, and was of the Charollais and Friesian breeds. There were also imports of cattle semen from New Zealand.

Fourteen attempts to smuggle animals into N.S.W. from overseas were detected. These involved 105 birds, a dog, 20 Salamanders, 3 snakes, 20 tortoises, and 52 eggs for hatching.

Imports of Animal Products

Imports of cheese, tinned meats, milk, and egg products, and raw hides and skins increased. A substantial import of fish meal from a new source, Peru, increased the total imports of this material. Imports of wool, mainly for carpet manufacture, doubled. These exceeded 5,000,000 lb. Animal hair imports also increased.

Greater control was exercised over the importation of noodles from certain countries, as false descriptions on invoices made it impossible to determine if egg noodles—a prohibited import—were in the consignments. Detailed examination of all such shipments was instituted.

Importation of hide pieces, feathers, stock feed concentrate, and biological substances decreased. Chilled meat from New Zealand decreased to 870,321 lb, some two-thirds of that imported in the previous year.

Seven consignments (217,123 lb) of frozen meat of Australian origin was returned from the U.S.A. after being refused entry there. This was an increase over that returned in 1967–68.

Passengers' Baggage

Co-operation with Customs officers continued, in searching for illegal goods in the baggage of passengers arriving by sea and air. Total seizures of the main items included 3,931 lb meat, 2,627 lb cheese, 1,568 lb trahanas, and 1,162 eggs.

Illegal importation of food and other materials of animal origin constitute some of the most serious matters facing the Animal Quarantine Service. This problem is growing with continued increase in passenger arrivals. In 1968-69 there were 108,435 passenger arrivals by ship and 592,175 by air, compared with 88,597 and 409,611 in 1967-68.

Disinfection of Footwear and Clothing

Disinfection of footwear and work clothes brought by incoming air passengers who had been associated with rural industries in countries where foot and mouth disease exists, continued. Some 2,569 pairs of shoes were disinfected and thirty-one clothing articles detained for laundering, from 1,550 such passengers.

Clearance of Service Personnel

In co-operation with Department of Customs and Excise, a quarantine officer accompanied Customs officers interstate on one occasion to board naval vessels returning with Australian Army personnel from overseas, so that they could be cleared to facilitate immediate disembarkation at Sydney.

Parcels Post

Continued attention was given to the clearance of quarantine-interest parcels at Sydney, Newcastle and Port Kembla. Many items of exotic food of animal origin were seized. The more significant seizures were 1,152 lb meat, 191 lb cheese, 67 lb trahanas, 71 eggs and 343 lb noodles.

Incidence of falsely labelled tins, faulty declarations and other devious methods used to try and prevent the detection of prohibited materials was as great as in previous years.

Supervision of Ships' Pets

Supervision over pets on overseas ships visiting Sydney and Newcastle, and the minor ports, was strict. On occasions, ships' officers were instructed to tighten precautions against escape. A bond signed by a ship's master was estreated because the absence of the pet, which had allegedly died, could not be satisfactorily explained.

Four dogs, two cats and one rabbit were destroyed following ship master refusal to sign a bond.

Export of Animals

Control over the export of animals involved inspection and sometimes supervision of treatment as required by an importing country.

Total of day-old chickens exported continued to show the decrease apparent for a few years past. Horse, cattle, goat and swine exports also decreased.

Sheep exports increased considerably, due to a shipment of 4,010 to Colombia. Cat, bird and fish exports also increased.

Dog exports increased over the previous year; 1,868 were exported, to forty-three countries. Main exports of dogs comprised 753 to America, 308 to Hong Kong and 242 to New Zealand.

Livestock Health—Research

VETERINARY RESEARCH STATION, GLENFIELD

Brucellosis (Bovine)

Examination of Vaccines.—A further two commercial 45/20 vaccines were examined for ability to protect guinea pigs against challenge, and effect on rectal temperature and milk production of adult cattle. The agglutinating antibody response was examined in cattle that were (i) uninfected and unvaccinated, (ii) recently infected, and (iii) previously vaccinated with Strain 19. It was also studied in guinea pigs. Local reactions in cattle vaccinated intramuscularly and subcutaneously were also recorded.



Major Mastitis Control Programme Launched

The Programme based on recommendations of the National Expert Panel on Bovine Mastitis (1966) has been comprehensively launched. See page 65 and page 91 for an account. Already, thirty of the intended forty Demonstration farms are functioning within the Programme.

One vaccine adequately protected guinea pigs against challenge with 500 and 5000 *Brucella abortus* strain 544 organisms where the other (which was imported) did not. Adequate protection was not achieved using a commercial Strain 19 vaccine tested as a control.

The immunogenic 45/20 vaccine produced little or no agglutinating antibody response in guinea pigs and cattle, but the unsatisfactory vaccine produced some response in adult cattle. Highest serum agglutination titre recorded was equivalent to 67 I.U. antibody/ml. This latter vaccine did not produce any significant antibody response in infected cattle or cattle previously vaccinated with Strain 19.

Both 45/20 vaccines produced large local reactions in cattle at the site of injection. These reactions were much more obvious when the vaccine was injected subcutaneously, but the local reactions developing after the second injection—intramuscularly or subcutaneously—were much more pronounced. Adult animals appeared to be affected more than calves.

The two vaccines produced marked febrile reactions. These started 1–2 days after the first vaccination and persisted for 24 to 48 hours. After the second vaccination the febrile reaction persisted for 48 to 96 hours and was obviously biphasic, with the higher temperatures recorded in the evenings. Milk production generally dropped 1 to 4 lb per day for a short period, but rapidly returned to normal.

A disturbing finding was the failure of the Strain 19 vaccine to adequately protect guinea-pigs against challenge. This failure is to be further investigated, but it is apparent that much greater control over the potency of batches of Strain 19 will have to be exercised by manufacturers and registering bodies.

Identification of *Brucella* Strains.—Most strains recovered from cattle resembled *Brucella abortus* biotype 1 although a few penicillin sensitive, carbon dioxide independent strains resembling Strain 19 were recovered. One dye sensitive strain was also isolated.

Strains of *Br. abortus* and *Br. suis* recovered at the District Veterinary Laboratories were submitted to Glenfield for identification. As phage typing, agglutination tests with mono-specific sera and examination of amino acid and carbohydrate utilization patterns could not be undertaken, these and other strains are to be sent to the *Brucella* Reference Laboratory (Commonwealth Serum Laboratories, Melbourne).

Complement Fixation Test.—An apparently satisfactory C.F.T. for *Br. abortus* infection was established. Determination of the significance of the recorded reactions is proceeding.

Mastitis

Methods of processing milk samples were improved, staphylococci being subjected to a tube coagulase test. Those that produced coagulase were identified as *Staphylococcus aureus* and those that did not, *Staphylococcus epidermidis*. *Streptococci* were classified according to their reaction on aesculin agar and to the Camp test.

A total of 1,759 milk samples from 152 herds were examined. Bacteriological results were as follows:

Organism	Isolated from	
	Herds	Samples
<i>Staph. aureus</i>	128	683
<i>Staph. epidermidis</i>	95	582
<i>Strep. agalactiae</i>	51	194
<i>Strep. dysgalactiae</i>	8	14
<i>Strep. uberis</i>	25	40
<i>Bacillus</i> spp.	10	15
<i>Coliform</i> spp.	16	16
<i>Cornebacterium pyogenes</i>	1	1
<i>Pseudomonas</i> spp.	1	1
No visible growth	87	400

Sensitivity tests were done, using the disc method on pools of up to five organisms per test. The sensitivities of the common mastitis pathogens (*Staph. aureus*, *Staph. epidermidis*, *Strep. agalactiae*, *Strep. uberis* and *Strep. dysgalactiae*) have been recorded relative to each of the following antibiotics: penicillin 5 i.u., streptomycin, chloramphenicol, nitrofurantoin, erythromycin, tetracycline, ampicillin, spiramycin, cloxacillin, nitrofurazone, furazolidone, and neomycin.

Worms (Cattle)

Study of the epizootiology of cattle worms, supported by funds from the Australian Meat Research Committee, was extended to properties on the south coast, southern tablelands, central tablelands and an additional property on both the north coast and northern tablelands. The aim is to determine the seasonal pattern of worm burdens in young dairy and beef cattle, their influence on growth rate and the best method of control.

The pattern of worm and liver fluke infections is followed in young cattle from the age of 3 months to 2 years. Body weights at monthly intervals, of calves treated with anthelmintic every four weeks, are compared with those of untreated controls. The level of the worm burden and the type of worms present are determined by worm egg counts, worm larvae examinations, and total and differential worm counts on slaughtered steers.

Winter occurrence of *Ostertagia*, *Cooperia* and *Oesophagostomum* was observed on the northern tablelands for the second successive year. The parasites declined as the animals grew older and resistance to infection increased. However, a significant increase of inhibited larval stages of *Ostertagia* again occurred in late spring–early summer, and the adult population reached a maximum in the early autumn when the animals were 15–16 months of age. Scouring and loss of condition in similar age cattle, due to *Ostertagia*, were also observed on district properties at this time.

On a north coast property moderate *Cooperia* infections and very low liver fluke burdens were observed in preliminary studies. *Cooperia* and *Ostertagia* were the main parasites encountered in early observations on the central tablelands but detailed examinations had not started. On the southern tablelands no significant weight gains were made by the monthly treated groups. Worm ova counts remained low. Trial work started on a south coast property during the 1968 drought. *Ostertagia* infections reached peak levels (855 eggs per gram) when the calves were 8 months old, and caused some deaths.

Worms (Sheep)

Studies on seasonal fluctuations in nematode egg counts of sheep were continued on a number of properties. At Grafton and Trangie treated and untreated groups of sheep under different management systems were compared, and at Grafton the efficiency of strategic anthelmintic programmes was also assessed. As in the previous year, outbreaks of haemonchosis at Grafton in the late summer–early autumn of 1969 showed that eight-weekly treatments—together with frequent rotation of grazing paddocks—were inadequate for parasite control.

Three strains of *Haemonchus contortus* and two strains of *Trichostrongylus colubriformis* resistant to therapeutic dose rates of thiabendazole were maintained in laboratory sheep for further investigations. Experiments on the resistance of these strains to increasing dose rates of parabendazole were started.

A simple method to recover infective worm larvae from bulk pasture samples was developed. Efficiency tests of it showed a consistent recovery of 95 per cent of larvae when added to 10 cc of settled pasture sediment. On one occasion, 12,000 worm larvae per pound dry herbage were recovered from each of two 1-acre plots. The method should assist in the ecological studies of nematode larvae on sheep and cattle pastures.

Worms (Pigs)

In a comparative anthelmintic trial at the Grafton Agricultural Research Station using thiabendazole, parabendazole, tetramisole and pyrantel tartrate against natural infections of gastro-intestinal nematodes in pigs, thiabendazole, parabendazole and tetramisole showed high efficiency against *Hyostrophylus* spp., *Oesophagostomum* spp. and *Strongyloides* spp. Pyrantel tartrate (banminth) was effective against the first two parasites but showed no activity against *Strongyloides* spp. The anthelmintics used were ineffective against *Trichuris* spp.

Liver Fluke

Studies started this year on the importance of liver fluke (*Fasciola hepatica*) infections in sheep and cattle. A survey of liver condemnations at abattoirs, field trials to assess the effect of infections on growth rates of young cattle, and laboratory studies of artificial infections, form the first stage of the programme.

Preliminary results of the survey (a joint project with the Meat Inspection Service at twenty-three abattoirs, on 61,000 cattle and 120,000 sheep livers examined during the period July, 1968, to January, 1969) are summarized in the following table:

	Causes of Liver Condemnations (in percentages)				
	Liver Fluke	Hydatid	<i>Cysticercus tenuicollis</i>	Non Parasitic	Total condemned
Cattle	21	8	..	6	35
Sheep	14	6	5	6	31

The approximate annual wholesale value of the condemned livers was estimated at \$200,000 for cattle and \$600,000 for sheep; based on 60 cents for each beef liver and 15 cents for each sheep liver.

A procedure for grinding and sieving whole livers for identification of flukes was introduced, to determine the significance of recovered numbers of immature and adult parasites. The recovery of trematode ova from faeces by sedimentation was investigated as an alternative to the sliding top chamber method of estimating egg numbers. The method was time-consuming but gave greater accuracy and is to be used mainly for research projects.

Laboratory maintenance and propagation of the liver fluke intermediate host *Lymnaea tomentosa* was commenced. As a result, large colonies have been produced for research purposes. One group of snails was infected with miracidia. The metacercariae later obtained were used for the artificial infection of mice, guinea pigs and calves.

Intestinal Fluke (Ducks)

The small round fluke *Sphaeridiotrema globulus* was recorded in ducks for the first time in Australia. It caused a heavy mortality in 4-6 week old domestic ducklings in a backyard flock in the Sydney area. Studies on the life cycle of the parasite are proceeding.

Ecto-Parasites (Sheep)

The screening trial with the tin compound (TBTO) against sheep lice was completed and a further trial against sheep ked undertaken. The compound showed good efficiency against lice (*Damalinea ovis*), but against keds (*Melophagus ovinus*) was only effective at toxic levels.

Poultry Disease Incidence Survey

The disease incidence survey started in 1966 and based on specimens submitted to the laboratory was continued.

Significant increases in incidence over those of 1967-68 were observed in fowl cholera (from 1.5 to 4.0 per cent), avian encephalomyelitis (0.8 to 2.6 per cent) and mismanagement problems (from 3.2 to 8.0 per cent).

Decreases occurred in infectious bronchitis-nephrosis (from 14.8 to 8.4 per cent), infectious laryngo-tracheitis (from 4.9 to 0.4 per cent) and Q disease (from 4.1 to 0.8 per cent).

Mareks disease and leucosis (13.0 per cent), infectious bronchitis-nephrosis (8.4 per cent), and mismanagement (8.0 per cent) were the most common problems observed.

Pullorum Disease

Incidence Survey.—*Salmonella pullorum* was isolated from five consignments of chickens and one consignment of pullets; compared to twelve isolations in 1967-68 and forty isolations in 1966-67, from similar sources. Cultural examination of 361 reactors from seventy-seven consignments of fowls yielded eighteen isolations of *S. pullorum* and six isolations of *S. typhimurium*. These were increases over 1967-68; wherein five isolations of *S. pullorum* and no isolation of *S. typhimurium* were recorded from similar sources. Cultural examination of 952 eggs from 315 fertile egg supply farms yielded eight isolations of *S. pullorum*. *S. typhimurium* was not isolated.

Variant Strains.—Rapid whole blood, rapid serum plate, and tube agglutination tests were done on all reactors submitted. Results are being evaluated as part of a project started in 1966; aimed at assessing the efficiency of various antigens and tests in detecting infection with variant and standard strains of *S. pullorum*.

All isolates of *S. pullorum* since 1966 were typed using specific antisera, ammonium sulphate sedimentation, and diluted antisera. Eighteen isolates from 1968 were typed as being seventeen variant strains and one intermediate strain. All fourteen isolates in 1969 were typed as variant strains. Results of typing are being compared with the serological reaction of the bird involved.

Rapid Whole Blood Test Antigens.—Whole blood, stained antigens from two Australian and three overseas commercial manufacturers were evaluated according to a set of standards developed at this laboratory. Antigens were examined for sterility, physical appearance, density, pH, autoagglutination, reactivity with standard and variant antisera, reactivity with specific 01, 09, 012 and 012₃ antisera, and reactivity with a flock of negative and positive fowls infected with variant and standard strains.

During the year, twenty-eight different batches of antigen were examined. To finally evaluate the efficiency of the antigens, all reactors submitted for culture were tested with a number of batches and results compared with presence or absence of infection. The results are now being correlated and assessed.

Non-specific Reactors.—Some commercial flocks officially classified as pullorum-free experienced a non-specific reactor problem. *S. typhimurium* infection was apparently responsible in several. High titres to this organism were demonstrated in pullorum reactors and were shown to cross-react with specific 012₃ antisera. An attempt is being made to assess the presence of similar organisms in negative reactors.

Selected sera were obtained from certain flocks, for testing for specific antibodies by rapid plate agglutination tests with a variety of stained antigens. Specific sera containing factors 01, 04, 05, 09, 012₂ and 012₃ were developed for standardisation of the stained antigens. Removal of fat from selected sera by ether extraction failed to affect the non-specific reactivity of the sera. A non-specific reactor problem, unrelated to infection with organisms sharing somatic antigens with *S. pullorum*, also appeared to exist.

Salmonellosis

Due to use of a wider range of selective and enrichment media, greater numbers of *Salmonella* spp. were isolated this year and a range of serotypes from various animal species.

Studies on the diagnosis of *Salmonella typhimurium* infection occurring naturally in a poultry flock gave the following findings: wide fluctuations in agglutination titres from week to week; erratic excretion of the organisms, as determined by cloacal swabbing; failure of culturally positive birds to react to some tests with one or more antigens; more infected birds detected by *S. pullorum* rapid or tube antigens than by homologous or heterologous *S. typhimurium* rapid or tube antigens; only 10 per cent of reactors positive for *S. typhimurium*, on culture.

A small flock of fowls was observed for serological response to *S. typhimurium* inoculated intramuscularly and orally. Results are summarised as follows: (a) a heterologous tube antigen detected 95 per cent of inoculated birds over a period of 9 weeks, in the group inoculated intramuscularly; only 14 per cent of birds in the group inoculated orally reacted to a heterologous antigen; (b) standard and variant pullorum antigens were noticeably less efficient than *S. typhimurium* antigens in detecting agglutinins in birds inoculated by both routes; (c) *S. typhimurium* was recovered 9 weeks later from 75 per cent of the birds inoculated intramuscularly and 25 per cent of birds inoculated orally.

Agglutinating sera were produced in cockerels and used to compare twelve rapid whole blood antigens produced from local and introduced strains. One selected antigen reacted more efficiently than an *S. pullorum* antigen in a flock of cockerels artificially inoculated with *S. typhimurium*. Appraisal of local antigens to select a strain suitable for field use will continue.

In conjunction with a private laboratory and the N.S.W. Egg Marketing Board, bacteriological and serological tests were done as part of a programme aimed at controlling the disease in poultry. Bacteriological examination of 117 reactors to *S. pullorum* and *S. typhimurium* stained antigens yielded only five isolations of *S. typhimurium*. Examination of seventy-four batches of dead-in-shell embryos originating from suspect infected farms yielded *S. typhimurium* from one batch.

To assess the role of by-product plants in the spread of the disease, forty-seven jute sacks and seventy-two samples of offal were cultured. *S. havana* was isolated once from each source. There was no isolation of *S. typhimurium*.

Rats and mice obtained from eleven poultry farms were examined bacteriologically. Of thirty-two consignments cultured, *S. typhimurium* was isolated from eight. These came from seven of the eleven farms, indicating the organism's wide distribution in the rodent population and the latter's likely significance in spread of the disease. In fact, isolation of *S. typhimurium* from rodents on certain farms was reported to be correlated with outbreaks of the disease in chickens originating from these farms.

Swine Erysipelas

All pig sera received at the laboratory for any purpose were submitted to the agglutination test for *Erysipelothrix insidiosa*, to determine the possible significance of reactions. The tabulated reactions recorded in 433 sera for which field information was available, suggested that a titre of 1/200 or greater could be of some significance. Further studies are needed for firm conclusions.

Cysticercus bovis

In the continued survey to assess *C. bovis* incidence in slaughter cattle, four of thirty-five lesions examined were positive for presence of a recognisable scolex. Many of the unconfirmed lesions were probably degenerative *C. bovis* but positive diagnosis was not possible.

Colibacillosis

To determine the significance and investigate the pathogenicity of *Escherichia coli* strains isolated from cases of diarrhoea and oedema disease in pigs, isolation of serotype strains was attempted here and at the two District laboratories.

Antisera for routine antigens of six enteropathogenic porcine strains of *E. coli* were prepared in rabbits. Also, four antisera against somatic and capsular antigens of strains sometimes isolated from cases of diarrhoea were prepared. A further eight enteropathogenic strains and six strains necessary to obtain monospecific "K" factor antisera were imported from Weybridge. Antisera against an enteropathogenic ovine and bovine serotype 078 and an avian serotype 02 have also been produced in rabbits.

Sheep Pneumonia

Border Leicesters' inherent susceptibility was investigated by analysis of flock records in an affected stud, and by examination of lambs of Border Leicester and Merino breeds and their crosses from a production trial. The lambs, which had been run together in the production trial, showed high incidence in Border Leicesters, nil in Merinos, and intermediate in their crosses.

Border Leicester ewes have been obtained from pneumonia affected and pneumonia free flocks so that their progeny can be examined for susceptibility differences.

Heat Penetration of Carcasses

Further tests to determine rate of heat penetration into a carcass during autoclaving were done with the help of Department of Public Works engineers. Thermocouples inserted into solid hindquarter tissue of a young bull's carcass showed the following: (i) rate of temperature rise in skin-covered tissue (2 inches depth) was only half of that in tissue of equal depth not covered by skin; (ii) within the range ambient to 100°C, temperatures in skin-covered tissue rose at about 1°C per 4 minutes after lag phases of 30 minutes at 2 inches, 55 minutes at 3 inches and 125 minutes at 4 inches depth; (iii) by comparison with a previous experiment using a smaller load (when temperature rises of 1°C per minute were achieved) the rate of rise was close to inversely proportional to the load; (iv) more than 7 hours was required before all probes, up to 5 inches deep in skin covered tissue, reached 100°C and 10 hours before all approximated chamber temperature; (v) for practical purposes, heavy loading should be treated by overnight sterilization.

Vibriosis (Sheep)

In a trial involving experimental infection of ewes with *Vibrio fetus*, abortion in the two high rate groups seemed due to massive placental infection, and abortion tended to occur sooner after challenge than with the lower two dose rates. More lambs born or aborted by ewes that received the lower two dose rates had typical liver lesions of vibriosis,

suggesting that these two dose rates were not enough to cause massive placental lesions and subsequent early abortion. With these two dose rates the organisms tended to localize and cause characteristic lesions in the lambs. Attempts to isolate vibrios from liver biopsy specimens failed. Further work designed to characterize strains isolated from field outbreaks was started.

Specific Pathogen-Free Poultry Flock

A flock of 200 birds from a *Salmonella pullorum* and Newcastle disease-free source was established. The flock has been monitored for *S. pullorum*, *S. typhimurium*, *Mycoplasma gallisepticum*, Newcastle disease, infectious bronchitis, infectious laryngotracheitis and avian encephalomyelitis. Strict sanitary precautions were enforced and movement of personnel restricted.

Avian Encephalomyelitis

The van Roekel strain of avian encephalomyelitis virus was obtained and stocked in quantities for embryo susceptibility tests in surveys.

A survey was done by testing seventy-six fertile-egg supply flocks supplying eight hatcheries. Two flocks were found to be susceptible (100 per cent embryos susceptible), six flocks showed evidence of a recent infection (50–100 per cent embryos susceptible) and the remaining flocks were immune. Age of the flocks surveyed varied widely. The survey will be extended by sampling of flocks at 9, 12 and 18 months of age.

Newcastle Disease

The survey started in 1966 was continued on flocks in the Sydney and Newcastle area. Results from 1966 to 1968 did not indicate any marked change in flock or bird incidence, except that the most recent test of flocks in the Newcastle area showed the incidence as low.

Broiler Mortality Survey

A disease survey was started in co-operation with a commercial hatchery. Nine broiler flocks totalling 69,368 birds in four farms were included in the survey. All dead and cull birds were autopsied and a diagnosis given where possible. A random sample of 0.25 per cent of birds in each flock were bled and will be tested for evidence of *Salmonella pullorum*, *S. typhimurium*, Newcastle disease, infectious bronchitis, infectious laryngotracheitis and *Mycoplasma gallisepticum* antibodies. Each disease syndrome is being evaluated in terms of daily and weekly mortality, sex difference, and losses due to the need to cull affected birds.

Infectious Laryngotracheitis

A stock of known-titre virulent virus was produced for challenges; for work at Glenfield and other institutions. Other strains were also stocked and titrated before use in virulence tests and vaccination trials.

Preliminary laboratory and field trials of the drinking water method of vaccination gave most promising results. The protection was comparable with that by conjunctival vaccination. Contrary to earlier belief, virus viability persisted in drinking water—with very little loss of potency—for the few hours needed for the birds to consume enough.

A dose response trial using the SA2 vaccine via the conjunctival route was nearly completed. A dose of 1,000 pock forming units (pfu) of virus appeared adequate to protect against an artificial challenge of 1,000 pfu of virulent virus given intratracheally. Serum neutralization tests on the experimental birds were commenced, to determine the serological response to the various doses of vaccine and to subsequent challenge.

A suggestion that conjunctival vaccination may cause ill effects in young chicks derived from non-immunized parents is being examined.

"Q" Disease

Incidence of this was much less than in previous years; only six cases referred to the laboratory, as against thirty-two in the previous year.

An examination of a possible role of fungi in the aetiology was inconclusive, and there was no further evidence to indicate a virus as the cause.

Enzymology

Enzymes in serum have been further studied. Stability in transit and in storage, and the effects of boracic acid preservative have been defined. Enzymes tested were stable for considerable periods in the frozen state at -12°C . Boracic acid cannot be used in serum to be assayed for ornithine carbamyl transferase activity. The method for assay of serum lactic dehydrogenase was established, and relevant criteria defined. Temperatures during assay were found to be critical.

Biochemical Parameters in Blood of Sheep

A project was started to establish the pattern of selected biochemical and haematological parameters in the blood of normal sheep. Effects of age, breed, sex and physiological states such as pregnancy lactation are being examined and compared in differing environments. Using the information obtained, changes from normal are to be defined in experimentally produced conditions caused by disease of nutritional, infectious or parasitic origin. The base line data will be established from various groups of sheep which have been selected in four flocks.

A group of ten ewes from the Glenfield flock was used to study the effects of pregnancy toxæmia induced by restricted feed intake for 8 weeks before lambing. Effects of stress of transport, and also of shearing, were investigated on the ten rams and seventeen ewes from Trangie.

Methods for Vitamin Studies with Cattle and Sheep

Use of two-dimensional paper chromatography for separation and estimation in biological materials was continued. As part of a co-operative project to examine the constituents of blood from healthy dairy cattle of various ages and environments, the total carotenoid, beta-carotene and alpha-tocopherol levels were determined. A similar project with sheep is in hand.

Conventional colourimetric procedures for vitamin A in serum and tissue were critically re-examined, and compared with modifications of the paper chromatography technique. Current modifications promise considerable advantages.

Toxicology Studies

A survey of nitrate and cyanide in plants included several extensive collections from the southwest and northwest. Some 361 of 1,150 samples tested were positive for nitrate at a high level, and 125 of 1,295 samples for cyanide.

Levels of arsenic in the kidneys of newly-born lambs on a Wellington property were as high as 0.3 ppm arsenious oxide. In light of this finding, material from the Glenfield flock was examined—with similar results. This appears to be a background level from environmental contamination in the past, and suggests placental transfer and foetal storage. Possible effects on lamb viability after shearing and dipping in arsenic before lambing will be investigated.

Pesticide Residues

Two experiments were done in conjunction with Division of Science Services, to determine treated-feeds residues in fowls and eggs. Residues in body fat or eggs from birds consuming diets containing up to 2,500 ppm malathion (malathion) for 13 weeks were negligible.

Samples of eggs, liver, kidney and breast muscle were taken at intervals during a seven weeks' experiment wherein groups of fowls had diets containing 20 ppm or 10 ppm of mercury as phenyl mercuric acetate or methyl ethyl mercuric chloride. Results of the analysis were not yet available at the time of this Report.

Noxious Animals Research

Rabbits.—Two trials were completed. One trial compared the efficiencies of carrots, "conventional oats" and "one-shot oats" as furrow bait for the sodium fluoroacetate ("1080") poison. The trial was done under conditions of lush, green pasture and extremely high rabbit populations. In these conditions carrot proved far more efficient than both types of oats.

In the second trial, the efficiencies of carrot, "conventional oats" and "one-shot oats" were compared on a large freshly cleared and burnt area with relatively low rabbit populations.

The bait was spread from an aeroplane. "Conventional oats" was as efficient as carrots under these conditions, but "one-shot oats" was much less efficient. "One-shot" is susceptible to deterioration by water. The wet weather prevalent during the trial could explain the low kills from this bait.

A third trial has been started, to test various warren-poisoning methods in the far west. Involving repeated surveys of marked warrens, and a monthly spotlight transect count through treated and untreated warren areas, this trial will continue for a few years.

Foxes.—A survey requiring State-wide collection of many foxes was commenced and will continue at least for 2 years. Primarily it is to ascertain the distribution of *Taenia ovis*, the tapeworm stage of *Cysticercus ovis* known as "sheep measles" in sheep. The specimens received are providing also data about other endoparasites, the stomach contents and reproductive biology.

Dingoes.—In conjunction with the School of Human Genetics at the University of N.S.W. a study on various blood enzymes and protein in dingoes, domestic dogs and various other *Canidae* has begun. The work could lead to methods of distinguishing dingoes from domestic dogs, and possibly the different geographical races of dingoes—with evident control implications.

Feral Goats.—A small study on the biology of feral goats was begun in the Upper Hunter Region. It involves a complete-area plant collection and regular collection of biological specimens. Knowledge gained from this study will include reproductive biology, food, and disease status of the feral goats in the area.

COLIN BLUMER DISTRICT VETERINARY LABORATORY, ARMIDALE

Enterotoxemia Vaccination Trial (Cattle)

This was to determine the relative significance of enterotoxemia and of bloat as cause of mortality in the high rainfall, high fertility, clover-dominant cattle-raising areas. Cattle were inoculated with *Clostridium perfringens* type D vaccine, or with both type C and D vaccines. There were unvaccinated controls. The Commonwealth Serum Laboratories, Melbourne, undertook serum titre determinations to assess the attained level of protection. Seasonal conditions in the observation period were unsuitable for either disease.

Acute Selenium Toxicity (Lambs)

To determine the lethal dose of parenterally administered selenium an experiment was done in collaboration with Dr C Caravaggi, University of New England, and the Veterinary Inspector, Armidale. The LD_{50} in lambs was found to be 455 ug of selenium per kg body weight when sodium selenite was administered as a single intramuscular injection. The post mortem findings did simulate those seen in enterotoxemia. Sodium selenite is often incorporated in enterotoxemia vaccines. Accidental double dosing could cause mortality and confusion with that disease.

Copper Deficiency in Cattle

Liver samples were taken routinely from cattle slaughtered because of suspected tuberculosis, actinomycosis or cancer. Copper estimations are being done at Glenfield. The results, with those from "illthrift" investigations, should provide information on existence of copper deficiency in this area.

Brucellosis in Cattle

This project, aimed at determining the incidence of brucellosis within herds, and to compare various diagnostic procedures, has been only partly completed.

Survey of Internal Parasites in Pigs

In this project to determine the species of worms in pigs on the far north coast, and the relative incidence in pigs of different ages, the material was collected at abattoirs from January to June. Laboratory examinations are continuing.

CATTLE TICK RESEARCH STATION—WOLLONGBAR

Pending Retirement of Director

The Director, Dr R. V. N. McCulloch, reached retirement age in April but agreed to continue in office until the end of 1969.

Tick Fever

The complement fixation (CF) test for babesiosis was applied to 8,546 cattle, from fifty-six holdings in the Tick Quarantine Area. Only three were positive for *Babesia argentina*. Twenty-six stud Queensland cattle were tested for possible admission to the Area; fourteen of them were negative to preliminary CF tests and subsequent transmission tests.

A thorough review of all tick fever outbreaks since the start of CF testing in June, 1964 was begun in March, 1969 and is proceeding. The reason for it is that in more than half the outbreaks there has been no detectable tick infestation or known contact with other infections. Since tick fever is not known to be transmitted in Australia except by the cattle tick (*Boophilus microplus*) or by blood, it has been assumed that transmitting ticks have invariably been exterminated by the 14-day dipping instituted right after diagnosis. Tick dispersal studies at this Station have shown that invasion from Queensland by some infected tick larvae has been possible but must have been rare.

Using thick blood films and CF tests, babesiosis in eight small herds in southeast Queensland was surveyed by officers of this Station—by co-operation with the Queensland Department of Primary Industries. The results showed a level of active or quiescent infection similar to that existing near Brisbane (Mahoney, 1962, Aust. J. of Science 24-27:310), and entirely different from that in New South Wales.

Research continued towards improving the CF test and alternative cross-check tests.

Tick Ecology

In cattle tick life history studies, exposures were made at Wollongbar (pasture), Tabulam (pasture and forest) and Grafton (pasture). These studies showed that in the relatively dry parts of the Tick Quarantine Areas the winter in some years is markedly less adverse to ticks than had been expected.

In 1966 the winter-check to breeding at Grafton was akin to what would be expected in most seasons at Wollongbar. In 1968, by contrast, Grafton had 17 weeks from April to July wherein no engorged female ticks produced young. Eggs and larvae may be killed by hot, dry weather. So an adverse winter followed by a dry spell in the 40-inch rainfall belt of the Tick Quarantine Areas would very sharply reduce the tick population. On the other hand, late summer and autumn months at Tabulam and Grafton in all the years under review have greatly favoured ticks.

The ecological work at Grafton has importantly shown that ticks can thrive there when conditions suit, and has added to the knowledge on tick dispersal.

Because CSIRO work has shown that the reproductive powers of the cattle tick are much more variable than was thought, work proceeded towards counting the tick larvae which hatch at different times of the year at Wollongbar—instead of recording merely the apparently large, medium or small hatchings. It requires use of an electronic counter because of the millions of larvae.

That occasional tick larvae may be windbourne has been confirmed by continued studies. The number so carried appears to be so low that a valuable quantitative estimate of wind travel would be prolonged and expensive.

Doubts arose as to whether engorged female ticks could be carried from the stalls in drainage water, and so set up infestations elsewhere. They can survive immersion for 4 days. A check showed that all ticks entering the concrete sumps built for this were being killed, provided the fluid was held stagnant for a week.

No infestation was found in 1968-69 in cattle on the seven properties adjoining properties in the Bentley Area where four infestations occurred in 1966-67. The last tick was seen in November, 1967. Stock on these properties underwent 21-day dippings for 9 months in 2 successive years. This treatment, known capable of reducing tick numbers almost to the point of eradication, did on this occasion achieve eradication. It cannot always be depended on to exterminate ticks but it does show the great effectiveness of organophosphate acaricides.

Acaricide Studies

Prolonged study showed that the spray race is less efficient than dipping in a plunge bath by a wider margin than was expected. Spray race application has some advantages if only tick control is the objective: It could not be recommended for tick eradication.

That hammer-milling of infested lucerne hay could not be guaranteed to kill all cattle tick larvae has been shown.

Studies showed that the most effective acaricides against ticks do not cause harmful carcass residues.

The organophosphate dip fluids most recently introduced into general use have been shown not to be affected by water. Cattle could be dipped before rain or during rain or required to wade through water straight after dipping without reducing the efficiency of treatment.

Studies were undertaken to measure, if possible, any adverse effect of dipping on cattle production. It had long been established in the U.S.A. that the advantages of freedom from tick worry and tick fever greatly outweighed disadvantages of a dipping programme. Field observations in N.S.W. have indicated that dipping is generally harmless but, as tick worry and tick fever are now rare, some stockowners tend to emphasise difficulties and claim that dipping is damaging.

Milk production was weighed for 2 or 3 days before and after eight dippings of one Government and seven private herds. No reduction in yield followed the dippings.

The production of each cow in the herd at Wollongbar Agricultural Research Station was recorded daily for 7 weeks. On three occasions at intervals of 14 days, half the herd had a 3 mile walk and dipping; the other half had no treatment. Production was not reduced by the treatment.

In a beef herd of forty-two steers, fortnightly dippings and (on each occasion) a 6 mile walk, had no effect on growth rate as determined by 14-day individual weighings of treated and untreated steers.

RESEARCH—BOARD OF TICK CONTROL

Detecting Acaricide Toxicity Cases

From studies over the last 2 years it would seem that some use can be made of the levels of organophosphate detected in kidney fat, to establish more positively whether animals have died of organic phosphate poisoning.

Cholinesterase estimations on blood samples from clinical toxicity cases were also done, but their diagnostic value could not be assessed.

Acaricide Residues Research

Tissue Residues.—Following the previous years' trial to determine the toxicity of imidan when used as a spray, a further trial was done (at the Cattle Tick Research Station) to assess imidan elimination rate after spray treatments. The results showed rapid disappearance from the tissues and, at any stage, a lower tissue residue than for ethion or dursban. Levels in fat from various sites ranged widely but there was good correlation between samples within groups—in biopsy and in slaughter samples.

In a second trial using nexagan, there was no repetition of the abnormally high residues as in the first. The compounds disappeared rapidly from kidney fat (half-life 9-12 days, compared to 16 days for ethion) and the rate of elimination appeared to be increased by an increase in exposure. Residues in an omental and superficial fat were each smaller than those of heart and kidneys.

Carcasses.—Half-pound samples of adipose tissues taken from peri-renal depots after slaughter were analysed for residues of organophosphorus compounds used in tick control. Residues of ethion were consistently higher than of delnav (related to half-life—about 15 days compared with an estimated 3-5 days for delnav). Incidence of positives was twice as great for ethion as for delnav, for equal numbers dipped.

Dairy Products Residues.—The volume of work in this field increased greatly. Almost 1,400 estimations, on 894 butter samples, were done for organophosphorus compounds alone.

The statistics relating to levels in terms of numbers of cattle dipped are hard to interpret, but several conclusive facts were apparent. Residues of ethion in milk fat were higher than those of delnav (associated with the longer half-life of this compound).

It can be expected that during the dipping season there will be a large number of positive results. This has caused some concern as, on several occasions, all samples gave a positive result—with deposits up to 1.0 ppm.

During the dipping season the chlorinated hydrocarbon levels were very low. Very few positives were recorded.

Livestock Production Research

SHEEP RESEARCH—TRANGIE AGRICULTURAL RESEARCH STATION

Selective Breeding of Merino Sheep

Response to selection continued in most of the single-character selection flocks. However, response to selection for high clean-fleece weight ("fleece plus" flock) appeared to have ceased. Also, response in the face-cover selection flocks was very erratic; perhaps related to the scoring methods.

The commercial demonstration flock selected for wool production ("nucleus" flock) was 21 per cent above the stimulated control flock on clean-fleece weight. Also, the commercial flock selected both for fertility and wool production ("fertility" flock) was 21 per cent above the control. Both flocks showed such desirable characteristics as low degrees of skin fold and face cover, and high body weight.

The Bungaree strain of South Australian sheep showed the attributes characteristic of the strain, namely high body and fleece-weight, low crimp-frequency and low levels of skin fold and face cover.

Selection for Skin Fold

Investigations indicated that heritability of skin fold at various sites differs markedly, being particularly low on the side. This tends to lower estimates for component scores that include that for the side. Correlations between the various sites tend to be high and positive.

Preliminary estimates of correlated responses to skin-fold selection were in general agreement with previous estimates, although in many cases they were symmetric. Selection for skin-fold ("folds plus") did not increase clean wool production.

Selection for Fleece Weight

Selection for high and low fleece weights, the "fleece plus" and "fleece minus" flocks respectively, produced sheep of markedly different levels of wool production, even though little response has been achieved in the "fleece plus" flock since the first generation. A preliminary comparison of skin section material showed an increase in both fibre diameter and follicle density in the "fleece plus" flock.

Selection for Weaning Weight

Selection for weaning weight was shown to be effective in Merino sheep. When both "weight plus" and "weight minus" ewes were mated to Border Leicester rams, lambs from the "weight plus" ewes were 11 per cent heavier at weaning than those from the "weight minus" group. Milk production by the ewe and the growth potential of the lamb were about equal in their contribution to this difference.

Influence of Selection on Fertility

Direct selection for fertility has been practised in the "fertility" and "nucleus" flocks. This has involved culling all ewes which fail to rear a lamb and, in recent years in the "fertility" flock, using only twin born rams. The lambing and weaning percentage for both flocks were again above the "random" flocks.

In the flock selected for and against crimp number, fleece weight, weaning weight and face cover, there was no consistent change in fertility. Also, the flocks selected for high and low fold-score weaned the same percentage of lambs in 1968. Since their inception in 1951, the reproductive performance of the "fold minus" flock has generally been superior.

Influence of Selection on Efficiency of Conversion of Feed to Wool

Efficiency of Wool Production in High, Wool Producing Sheep.—Sheep selected for high, wool production were more efficient than unselected flocks. There was little effect on this increased efficiency when fibre diameter was held constant. The strong-woolled South Australian strains were more efficient than the unselected Peppin strain, but they were less efficient at *ad lib* intakes than the selected Peppins.

Maintenance Needs and Efficiency of Wool Production of Ewes in the Hybrid Vigour Trial.—Border Leicester and Merino sheep and their reciprocal crosses were compared for maintenance needs and efficiency of wool production. Significant differences were observed for wool production both per head and per unit area and, also, the efficiency of wool production, under both restricted and *ad lib* feeding. In each case, the Merinos ranked highest and the Border Leicesters lowest. However, the ranking of the breeds was reversed for the feed cost for a unit change in body weight. Thus, marked breed-differences appear to exist for these production characters and these are related to the purpose for which the breeds are used.

Maintenance Needs and Efficiency of Wool Production of Ewes in the "Skin-folds" Selection Flocks.—During the last 3 years, "folds plus" selection flocks have shown a 23 per cent greater greasy wool production than "folds minus" selection flocks. But when compared on a clean-wool basis this difference is reduced to 12 per cent.

The aim of this experiment was to determine whether the differences in wool production were due to differences in feed intake, to efficiency in converting feed to wool or to both. The "random" selection flock showed the greatest efficiency in converting feed to wool. This efficiency decreased as level of intake increased. The net efficiency of this group was also higher. Under *ad lib* feeding, the average intakes between the flocks did not vary.

Comparison of Lambing Management Systems

This project compared ewe and lamb mortality in flocks lambing under a drift system (which involved considerable supervision) with that of a flock given no supervision. Management of the unsupervised flock was altered in 1967 by dividing the flock into three groups based on anticipated lambing date—and bringing each to the yards only once for mothering, marking, and mulesing. Previously there was only one large mob and this was yarded twice during lambing.

As in 1967, the difference between the systems was much smaller than it had been in the years when the unsupervised flock was not subdivided. The losses in 1968 were 12 per cent in the drift and 13 per cent in the unsupervised group. Averaged for the years 1964 to 1966 the comparable figures were 12 and 23 per cent respectively for the two systems.

In 1968, a pen lambing-system was examined. Lamb losses to weaning were 23 per cent in the pen lambing-system compared with 22 per cent for comparable flocks in the drift.

Comparison of Seasonal Variation in Fertility of Bungaree and Peppin Ewes and Rams

Experiments between February and April, 1969, re-examined sperm transport and fertilization in Bungaree and Peppin ewes. The results were similar to those of 1968; poor sperm transport in Bungaree ewes during the first 8–10 days of joining in February–March, a higher return rate in Bungaree ewes during this period than during the remainder of joining, and a lower incidence of Bungaree ewes cycling during the first 17 days.

Fertilization rate was examined during April, 1969, and again, as in 1968, there was little difference between the two strains of ewes. It is therefore considered necessary to reassess the importance of embryo mortality in the low fertility of the Bungaree strain. Experiments in the last 5 years have not supported the hypothesis that embryo mortality is an unimportant factor in the relative levels of ova wastage in Bungaree and Peppin ewes.

Regardless of the precise cause of low autumn fertility in the South Australian strain, it appears that it can be largely overcome by an extension of the joining period beyond 4½ weeks.

Natural Pasture Grazing-Trial

This was to determine the productivity of natural winter annual pastures in the Trangie district. The value of areas of lucerne and natural perennial pastures in supplementing the summer "trough" in dry matter production of these pastures was also investigated.

During the first 2 years of the trial, the natural pastures carried 1, 1½, and 2 wethers per acre successfully. However, differences in the pasture composition became apparent at the different stocking rates. Whether these changes are detrimental to productivity is to be determined in succeeding years. The supplementary areas did not significantly increase production over the set-stocked areas. However, the lucerne stand being grazed was poor.

Experiments Using Dominant Lustre Mutant Fleece Types

The lustre mutant is a dominant gene affecting the fleece of Merino sheep. Although dominant, mating of heterozygous rams to normal ewes has given a segregation ratio of 1.14:1 instead of the expected 1:1. However, mating of heterozygous rams and ewes has yielded lustre and normal lambs in the ratio of 3.19:1, an excess over the expected ratio of 3:1.

Studies of skin sections indicated that the wool follicles of mutant animals are deeper and straighter than those of the normal Merino counterparts.

Association between Blood Characters and Production

This was a co-operative project with the Department of Physiology, University of New England. The aim was to establish the relationships, both phenotypic and genetic, between various blood characters and sheep productivity. Preliminary results indicated that clean-fleece weights are positively correlated with the level of potassium in the red blood cells.

Supplementary Feeding of Sheep

Wool production under different drought feeding methods was investigated in Peppin, Bungaree, and Collinsville strains of Merino. Oat based diets produced up to 25 per cent more wool than wheat based diets. Cottonseed meal produced more wool than peanut meal; 25 per cent in the diet giving as great a response as 50 per cent.

To find the most economic level of protein supplementation, a larger range of protein levels had to be investigated. It was also necessary to investigate a new technique of protecting protein as it could influence the economics of protein feeding. Of six levels of protein, the maximum response was obtained between 25 and 36 per cent replacement. No response was obtained at any level after formaldehyde treatment of the protein.

Because of this result, a range of formaldehyde treatments were investigated. Preliminary results indicated no response to any of the levels of treatment.

SHEEP RESEARCH—CONDOBOLIN AGRICULTURAL RESEARCH STATION

Breeding and Management Problems—Dorset Horns

Difficult births and stillborn lambs are a recognized problem with the Dorset Horn. Observations on the magnitude and type of difficulties have been made for the past two years on the Condobolin Research Station and private properties.

Losses appeared to be more severe at spring lambings, due mainly to higher birth weights. These were often associated with abnormal presentations, with generally one leg back, and the lamb caught by the head or horn buds.

A poll Dorset ram was introduced and joined to half the ewes at the autumn 1969 mating, to determine any differences which may be present between polled and horned lambs in terms of difficult births.

Pasture Trials

Natural Pasture.—This trial was designed to investigate the carrying capacity of natural pasture in the Condobolin District. Results indicated that 0.55 wether per acre can be carried without detriment to the pasture.

Jemalong Barrel Medic.—The optimum stocking rate and best management system were investigated. With predominantly barrel medic pasture there appeared to be no advantage in rotationally grazing or saving pasture for deferred grazing. About 1.6 wethers per acre appeared to be the best stocking rate.

Lucerne Grazing Management.—The effect of recovery time on productivity of a rotationally grazed lucerne stand at Condobolin was investigated. Lucerne production appeared to be related more closely to climate than to recovery time. The shorter recovery times of 21 or 35 days were insufficient for stand-persistence.

Selective Breeding of Merino Sheep

Effect of Selection for Weaning-Weight, on Crossbred Lamb-Growth.—In 1966 and 1967, ewes from the Trangie Agricultural Research Station's "weaning-weight plus" and "weaning-weight minus" flocks were joined to Border Leicester rams. The crossbred ewes were transferred to Condobolin and joined at 7 months of age with Dorset Horn rams. The reproductive performance of the two ewe crosses was similar for both joinings. Lamb growth-rate was slightly greater from ewes which were derived from the "weight plus" flock.

SHEEP RESEARCH—COWRA AGRICULTURAL RESEARCH STATION

Hybrid Vigour in Lamb Production

This trial was designed to measure the importance of hybrid vigour in crosses between Border Leicester and Merino sheep. Over 5 years the crossbreds exceed by 10 per cent the mean performance of the parent breeds for lamb survival, and by a slightly lower amount for birth weight (5 per cent), growth rate to weaning (8 per cent) and age corrected weaning weight (7 per cent). For the 1967 drop ewes, the crossbred ewes produced 18 per cent more clean wool than the average performance of the parent breeds.

The greatest effect of hybrid vigour was on the reproductive performance of F₁ ewes. For non-maiden ewes, the crossbreds have exceeded the purebred performance in the number of lambs weaned per ewe joined (49 per cent), the number of lambs born per lambing ewe (21 per cent) and in ovulation rate (43 per cent).

Grazing Systems for Lamb Production

The management and carrying capacity of improved pastures in the Cowra districts were studied. On a pasture of lucerne, rye grass and subterranean clover there was no advantage in rotationally grazing. Breeding ewes at 5.25 per acre could be maintained under set-stocking. No advantage was shown from saved areas under either set-stocking or rotational grazing.

Lamb growth was greatest on the set-stocked treatment. Under the rotational systems, set-stocking from lambing to weaning was superior to a system of rotational creeping.

SHEEP RESEARCH—COWRA AND GLEN INNES AGRICULTURAL RESEARCH STATIONS

Crossbreeding in Prime Lamb Production

In the first phase this trial compared the growth rates of Border x Merino, Dorset x Merino and Merino lambs, and the carcasses of the wether portion. In general, the Dorset x Merino lambs were superior in growth rate, weaning weight and carcass weight.

The second phase compared the lifetime production of the three types of ewes and the growth and carcass qualities of the progeny; when the ewes are joined to Border Leicester and Dorset Horn rams. The outstanding feature of this phase was the superiority of the Border x Merino ewes in number of lambs weaned for an autumn lambing.

SHEEP RESEARCH—LEETON AGRICULTURAL RESEARCH STATION

Autumn-Winter Nutrition of Breeding Ewes, on Irrigation

Production of autumn lambing ewes stocked at 4, 6, 8 per acre have been compared under different pasture management systems on irrigated land. The basic farmlet has been of subterranean clover and Wimmera ryegrass pasture. Values of ¼ and ½ of the farmlet area as summer pastures (paspalum-white clover) and/or sod sown oats have been studied. The resultant design has been a 3x3x3 factorial containing twenty-seven groups of six ewes, as follows: Stocking rate—4, 6, 8 ewes/acre; summer pasture—0, ¼, ½ of farmlet area; sod sown oats—0, ¼, ½ of farmlet area.

Data recorded include ewe bodyweight, wool production and teeth-wear measurements, together with lamb birth, growth and slaughter particulars. Pasture availability and composition changes have also been measured regularly.

Two years' results have indicated that eight ewes per acre is too high a stocking level for the production of prime lambs under an autumn lambing situation on irrigated land. Four ewes per acre were carried satisfactorily when set-stocked, provided that the annual winter pasture was spelled for at least 3 weeks after watering in February. Lamb growth-rates of 0.65–0.70 lb per day were obtained. Six ewes per acre were also carried successfully (with a reduction of approximately 0.5 lb per head of wool compared with four ewes per acre), and with lamb growth rates of 0.5 lb per day.

Grazing summer pasture at four and six ewes per acre appeared wasteful. At eight ewes per acre, increases in fleece weight and lamb birth-weight were obtained but the general level of production was still very low. Use of sod sown oats resulted in slightly increased pasture availability but production characters were little affected.

Border Leicester-Merino, Merino, Cheviot-Merino Comparisons

Border Leicester-Merino, Merino, and Cheviot-Merino ewes, bred from a common flock of Merinos, have been compared as prime-lamb mothers on irrigated pasture, after mating to Dorset rams in either spring or autumn.

Results during 1965 to 1967 showed that the Border Leicester-Merino ewe is superior to the Cheviot-Merino in terms of fertility, lamb and wool production and to the Merino in lamb growth, carcass quality and number of lambs dropped from an autumn joining. Wool production from Border Leicester-Merino and Merino ewes were similar, while price per pound of wool and number of lambs dropped from spring joining was greater from Merinos.

Results in 1968 have largely confirmed the previous findings except that the premium paid for Merino wool was greater. Gross returns per ewe joined for Border Leicester-Merino, Merino, and Cheviot-Merino ewes in 1968 were: (a) *Autumn joining*—\$9.19, \$8.83, and \$6.41 respectively; (b) *Spring joining*—\$6.50, \$8.62, and \$5.10 respectively.

Four years' results demonstrated that the Cheviot-Merino ewes under observation were relatively uneconomical as prime-lamb mothers because of low fertility (particularly lack of twinning) and lower wool production.

SHEEP RESEARCH—CSIRO DIVISION OF ANIMAL PHYSIOLOGY, PROSPECT, N.S.W.

Importance of the Ram in Flock Reproductive Performance

A system designed to telemeter the intra-testicular temperatures of freely grazing rams was made to function reliably for periods of up to 3 days. Accurate records were obtained from three rams and the main feature was that intra-testicular temperatures were higher than would be expected from comparable air temperatures applied in a climate room. The results are preliminary.

Design of an experiment was completed to evaluate the various combinations of time and temperature that produce infertility in rams. Work also continued on identifying a method whereby environmental heat load can be measured. The importance of radiant heat load to total heat load was observed.

Using four different ultrasonic foetal blood flow detectors, pregnancy could be detected with a prediction efficiency of 95 per cent at about 80 days' gestation. More familiarity with the instruments should enable an earlier diagnosis of pregnancy and perhaps the differentiation of single and multiple pregnancies.

SHEEP RESEARCH—GRAFTON AGRICULTURAL RESEARCH STATION

Control of Sheep Worms on North Coast

The trial compared three anthelmintic treatments, namely, from January to April (inclusive), 4-weekly treatment with thiabendazole, 4-weekly treatment with montrel (kempak), and thiabendazole (May to September), with no treatment. Wethers were stocked at seven per acre and divided into two groups—one set-stocked and the other rotationally grazed. Faecal egg counts were taken every 4 weeks.

Maximum parasite burdens occurred in autumn, but deaths from haemonchosis, and high faecal egg counts, have been recorded in each month of the year over the 3 years—depending upon climatic conditions. The results indicated that on the north coast, where sheep are not normally raised commercially, they should be drenched only when climatic conditions favour parasitism; while pasture should be heavily grazed and kept short, particularly in summer and autumn. Set stocking is preferable to rotational grazing.

Prime Lamb Production on the Lower Clarence River Alluviums

A trial to study the feasibility of prime-lamb production as an alternative to dairying was commenced. Merino and Merino x Dorset Horn ewes are being compared. Four-weekly drenching and a programme of tactical drenching are also being compared. Ewes lamb in autumn. Border Leicester rams are used.

Foxes have been a major problem by killing 22 per cent of lambs born on open range. However, nightly yarding eliminated this problem. Lambs from Merino ewes have shown better survival and were heavier than lambs from crossbred ewes. Refusal of crossbred ewes to allow lambs to suck, although acceptance was otherwise complete, has been a considerable problem.

SHEEP RESEARCH—TEMORA AGRICULTURAL RESEARCH STATION

Lucerne Grazing Management Trial

Management of lucerne at different stocking rates has been investigated at Temora. High stocking rates when set-stocked have caused lucerne to be killed very quickly. No significant difference between the five- and seven-paddock systems was noticed.

Shortening the rotation time between lambing and weaning gave some advantage in ewe body-weights and lamb growth-rates at the lower stocking rate. This response was eliminated at higher stocking rates.

Drought Feeding

Availability of fuzzy cottonseed, as a cheaper energy source than wheat, led to experiments as to its value for drought feeding. Cottonseed fed on the ground or in a trough, as a supplement to poor quality hay, was compared with hay or hay plus cottonseed meal. Small quantities of cottonseed were found to increase wool growth and maintain body weights. There was little wastage when cottonseed was fed on the ground.

Stocking Rate and Superphosphate Application on the Productivity of Merino Ewes Grazing Improved Annual Pasture

This experiment was designed to investigate the stocking rate and superphosphate application on an improved pasture. There was a slight response in body weight to increased fertilizer application, particularly at higher stocking rates.

The clover component of the pastures decreased with increasing amounts of fertilizer but yield increased up to $\frac{1}{2}$ cwt of superphosphate per acre. Annual weeds increased with fertilizer application and stocking rate.

Breed Comparison Trial

This trial was originally designed to compare the productivity of the Corriedale and Polwarth breeds at Temora, but was subsequently expanded to include the Peppin Merino, the Bungaree South Australian Merino and a fixed Border Leicester x Peppin Merino halfbred (BLM).

The Corriedale was superior to the Polwarth in greasy-fleece weight, number of lambs weaned, and growth rate to weaning. In the overall comparison the BLM flock weaned the greatest weight of lamb, and was superior to the other flocks in both reproductive performance and the growth of individual lambs.

SHEEP RESEARCH—YASS VALLEY

Farm Management Problems of Development in the Yass Valley

The broad aim has been to investigate alternative strategies for management and development of representative properties in the Yass Valley. The research has been along two lines.

The first line has been the collection and analysis of physical and financial farm records to provide a representative range of operating costs and returns in the area, and a realistic basis whereon to make assumptions for the second part of the project.

Secondly, linear programming models are being prepared for three types of representative farms. These are: (a) a developed farm model, where the object is to maximize the whole-farm gross margin in a particular year; (b) an undeveloped farm model, where the aim is to determine the optimum developmental plan to bring the property up to the standard specified in (a); (c) a highly-developed model where it is assumed that the best possible management is in operation. This model is to be used to clarify factors likely to limit production, and indicate the most responsive areas for future research. Results so far have been tentative.

SHEEP RESEARCH—IN CO-OPERATION WITH DISTRICT LIVESTOCK OFFICERS (SHEEP AND WOOL)

Lifetime Productivity of Single vs Twin Born Merino Ewes

On a number of properties, single and twin born ewe lambs were identified as soon after birth as possible and run together thereafter. Bodyweights were recorded at marking, weaning, and before mating each year. Body dimensions were recorded at weaning and before the 2-tooth and 4-tooth matings. Fleece production and fertility data were also recorded.

On the one property where fertility data for 1968 were available, twin ewes 36 months old produced significantly more twins than did single ewes, although the general level of twinning was low.

Differences in fleece weight between single and twin born ewes disappeared after 18 months of age, and in body dimensions between 12 and 18 months of age.

Ram Percentage Comparisons

Effect of ram percentage on fertility was studied on a number of properties. On each property two groups of 200 ewes; one group joined with 1 per cent, and the other group with 3 per cent of rams. On most properties differences in the number of dry ewes at lambing were not significant, although slightly more ewes lambed where 3 per cent of rams were used. The only significant difference occurred at Trundle. There, fewer ewes lambed in the 3 per cent group.

POULTRY RESEARCH—POULTRY RESEARCH STATION, SEVEN HILLS

Breeding Project (Eggs)

The current egg breeding programme was started in late 1959 when the reciprocal recurrent selection programme for egg production ended. The programme provides three egg production flocks and three corresponding control flocks, namely: *A Flock*—Australorps; *B Flock*—White Leghorns; *C Flock*—Synthetics (a closed population originally based on both crosses between White Leghorns and Australorps).

Each year, between 2,000 and 2,300 pullets have been tested in single-bird cages. Selection has been done with September-hatched chickens, on egg production to the end of June. This year, testing of the 10th generation proceeded.

In recent years, selections have been by using an index which includes both egg production and egg weights. Crosses between the parental lines are now proposed. These crosses will be made both ways. Thus there will be six crossbred populations as well as the three parental lines. Holding these nine lines for a full 2 years' production is intended, for assessment of feasibility of breeding for an extended laying period.

Higher Rate and Weight of Eggs.—Over the last 3 years, egg production has increased by 3.82 eggs per bird per generation. Over the same period, egg weight has gained 0.52 gms per generation.

Specific gravity (a measure of shell strength) has remained fairly constant; the Haugh Index (a measure of albumen quality) has improved slightly, and incidence of bloodspots has decreased slightly.

Broiler Breeding Programme

The eighth selected-generation of the broiler-breeding programme was hatched. A randomly selected control-flock mating was done at the time of the selected-breeder matings.

Until last year, progress had indicated that additive genetic variance was responsible for much of the variance for growth-weight in the two flocks. The low gain last year was thought to have been due either to a biased control-flock (as selections are at random and the flock is small) or a plateau. It was hoped that the latter was not the case. The gains made this year indicate that random variation was in all probability the reason for the results last year.



More and Heavier Eggs through Breeding/Selection

At Seven Hills Poultry Research Station the "Breeding Project (Eggs)" has within the past three years increased egg production by 3.82 eggs per bird per generation, whilst egg-weight has gained 0.52 gms per generation.

The poor weights this year were due to a disease complex involving uraemia and blackhead, while fowl pox vaccination at five weeks was also implicated as a possible triggering mechanism. In future the birds will not be vaccinated against fowl pox until after the 9-week weights.

New broiler houses at present under construction should provide more ideal conditions, wherein the high environmental component of variance will be appreciably decreased.

Genetic Correlation between Feed Conversion and Growth Rate in Broiler Chickens

Pedigreed chicks were run in individual cages to 4 weeks and then, from 4 to 9 weeks, in groups ranked on feed efficiency. Body composition of a sample of birds at 9 weeks was noted. Three lines were developed from the base population: one selected for high efficiency, one selected for low efficiency and a randomly selected control-line.

In general, performance during the early period (1-4 weeks) was only slightly related to later performance (4-9 weeks). The realized heritability of feed efficiency averaged 0.2, and the genetic correlation between feed conversion and growth rate averaged 0.33 (i.e., a positive relationship between feed efficiency and growth rate).

As there seemed to be only slight agreement between performance over the early period (1-4 weeks) and that over the later period (4-9 weeks), the acquisition of more reliable information over this latter period is intended. Feed consumption over this period was about five times as much as that over the early period.

High and Low Protein Sorghum in Laying Diets

There were four treatments: a control wheat-diet; two diets containing 77 lb of sorghum per 100 lb diet, one using high and one using low protein sorghum; and a high protein sorghum-diet supplemented with additional sources of protein. All diets were 17 per cent crude protein except that in which 77 lb of low (13 per cent) protein sorghum were used.

The only variable to show statistical significance was hen-housed production. The control diet was superior to the sorghum diets. Production on the supplemented low protein diet was best (not significantly) and the worst was on the 13 per cent total crude protein diet. Diets containing the low protein sorghum were associated with the heaviest mortalities.

Over-consumption of High Energy Layer Diets

Overseas research has revealed that the cost per unit-energy of layer diets declines as the diet's energy content is increased. But the ability of pullets to adjust daily feed-intake, to maintain a constant daily-intake of energy, is inefficient. So, "over-consumption" of energy occurs as the energy content of the given diet is increased.

An experiment was commenced to examine the influence of diets with increasing energy-content on daily feed-intake, daily protein and energy-intake, production and efficiency of feed, energy and protein utilization. The probable over-consumption rate of the diets was calculated and a second series of diets was given with the same energy—but reduced protein content—in an attempt to conserve protein and reduce cost without effects on production.

The diet of highest energy content (3300 k calories of metabolisable energy (ME) per kg) was given *ad lib* and for 8, 7, 6, 5, 4, 3, and 2 hours per day; to examine a possible method of avoiding over-consumption and the stress effects of restricted feeding.

A progress summary of the data has revealed that "over-consumption" of energy occurs as the energy content of the given diet is increased from 2700 to 3300 k cal ME per kg. However, contrary to expectation, reduction in dietary protein increased feed-intake and accentuated "over-consumption". This probably negates any savings in feed cost by protein conservation. Results of restricting the intake of the highest energy diet were variable. No definite trend was evident.

High and Low Protein Meatmeals

The purpose of this experiment was to compare the productivity of laying-pullets given diets containing meatmeal of high protein-low calcium content and meat and bone meal of low protein-high calcium content.

Egg production and efficiency of feed-utilization of pullets given diets with 9 per cent meat and bone meal were sig-

nificantly less than those of groups given diets with 9 per cent meatmeal. But the difference was eliminated when the total protein of the meat and bone meal diet was increased to that of the meatmeal diet with soybean meal.

Egg production and feed utilization of pullets given diets with 12 per cent meat and bone meal were similarly depressed compared to controls given 12 per cent meatmeal. But added soybean oil meal improved the efficiency of feed utilization without any beneficial effects on production. Pullets given diets containing 12 per cent meat or meat and bone meal had a lower production and efficiency of feed utilization than those given diets with 9 per cent meat or meat and bone meal.

Rearing and Laying Period Feeding, and Reproductive Performance of Broiler Pullets

Broiler-type pullets were reared from 11 to 22 weeks of age under the following feeding regimes: (a) 16 per cent protein, medium energy-diet given *ad lib* (controls); (b) as (a) given *ad lib*, and ICI 33828 (anti-fertility compound) included at the rate of 0.005 per cent of diet from 18 to 22 weeks; (c) 12 per cent protein high energy-diet given *ad lib*; (d) Diet (a) restricted to 90 per cent of *ad lib* to 18 weeks, and to 60 per cent of *ad lib* between 18 and 22 weeks, by feeding-time restriction on a 3-day cycle.

From week twenty-two, half of each group was given the laying diet *ad lib*. (f), and the intake of the remaining pullets was restricted (R) by covering the feeders for 2 days each week. The anti-fertility compound and restricted feeding delayed sexual maturity by 17 and 23 days respectively, reduced feed consumption over the rearing period by 8 to 22 per cent and reduced body weight gain over this period by 12 and 30 per cent. Rearing mortality was lower in the feed-restricted than in the low protein diet group. Rearing costs were 7 per cent higher in the anti-fertility compound group and 10 per cent lower in the feed-restricted group than in the controls.

Birds restricted (R) during laying ate 11 per cent less between 22 and 38 weeks than the full fed controls (F); were 6 per cent lighter at 38 weeks; grew at half the rate between 22 and 38 weeks; produced 10 per cent fewer eggs to 40 weeks; produced 35 per cent fewer hatchable eggs between 30 and 40 weeks; and gave 18 per cent lower net returns from 11 to 40 weeks.

Feed restriction during rearing doubled weight gain between 22 and 38 weeks, reduced egg production by 20 per cent, and reduced net returns from 11 to 40 weeks by 34 per cent. Average egg weight from weeks 20 to 30 in the low protein—restricted (CR) group was 1.7 grams lower than the full fed control (AF) group, and hatchable egg production from weeks 30 to 40 was reduced by 66 per cent. Laying mortality was lower in the restricted-restricted (DR) group than in the restricted-full fed (DF) and low protein full fed (CF) groups.

Feed Restriction and Lighting of Broiler Pullets

An experiment examined the effect of restricted feeding under two lighting systems (decreasing and increasing light) during the rearing periods, on the initial laying performance of broiler-type pullets. Treatments were imposed at 9 weeks of age and removed at 22 weeks. The trial was discontinued at 36 weeks of age.

Birds reared on restricted feeding reached sexual maturity 16 days later than full fed birds, ate 17 per cent less feed to 22 weeks, and gained 7 per cent less in body weight to 24 weeks of age and 10 per cent less to 36 weeks.

Birds reared under the decreasing lighting regime reached sexual maturity at the same age as those reared under increasing lighting, ate 5 per cent more feed during the rearing and laying periods, and gained 5 per cent more in body weight to 24 weeks.

The mean weight of eggs laid between 24 and 34 weeks of age from pullets subjected concurrently to decreasing lighting and restricted feeding was approximately 2 grams heavier than that of the other three treatment combinations. Mean egg weight was 1 gram greater in the restricted than in the full fed group, although the difference was not statistically significant. Laying mortality was lower in the restricted fed group than in the full fed group.

Trace Elements Survey in Australian Feedstuffs

A comprehensive survey of 196 samples of twenty local feedstuffs was done as a co-operative project with the Division of Science Services, Rydalmere. A method was devised for formulation of diets containing not less than a certain minimum or not more than a maximum of any given nutrient, based on

the mean and standard deviation of the analyses given. Greater precision in feed formulation, particularly in regard to least-cost formulation by linear programming, requires continued analysis to define more correctly the mean content of the various nutrients in each feedstuff and the standard error of the mean values.

Analyses conducted include: protein, moisture, fat, ash, sodium, potassium, calcium, magnesium, manganese, copper, zinc, and iron for wheat and its products, other grains, protein meals of animal and plant origin, dairy products, and miscellaneous feedstuffs.

Periodic Moulting

In a 2 year trial using crossbred hens in deep litter pens, there were four treatments: (i) Unmoulted; (ii) Moulded twice, using the drug ICI 33828; (iii) Moulded twice, using high levels of dietary iodine (as potassium iodide); (iv) Moulded twice, using conventional moulting methods.

The two moults, after 8 months and 16 months in lay, were successfully completed. Laying performance (measured as percentage production) on the conventionally-moulded treatment was superior to the control, but the other two moulting treatments were inferior. Mortality, however, was greatest amongst the controls. The first moult (by any method) decreased the size of eggs laid during the next 4 months. A relative increase in egg size (compared with control birds) followed the second moult.

The initial moult also improved albumen quality, apparent every time it was measured between the two moults. Moulting by ICI 33828 or conventional methods appeared to improve shell quality (as measured by specific gravity) for 6 months after the moult.

Stocking Rate and Feeder Space for Laying Hens on Deep Litter

Floor space of 1.5 and 3.0 sq ft per bird were factorialized with three feeder spaces, 0.5, 1.5, and 3.0 inches per bird. Plotting the percentage egg production on an individual pen basis revealed a tendency (although not consistent with treatment) where minimum floor space and/or feeder space was provided, for the birds to drop in production after the early peak. In some cases, these birds recovered in production towards the end of the laying year.

The overall result was that many pens would have been uneconomic after 6 months in lay—a situation far removed from commercial practice. The analysis involving return from eggs and culls over costs of feed and bird levy was not completed.

Lighting Treatments during Rearing

After two unsuccessful years, delays in sexual maturity by using decreasing light patterns have now been achieved—with consequent improvements in initial egg size. The sequence of trials has emphasized the importance of lighting in the early stages of growth (0–6 weeks of age).

To Rapidly Determine Egg Specific Gravity and Shell Strength: Suspension Weighing

A suspension weighing technique, developed for rapid determination of specific gravity of eggs, was compared with one using solutions of known density. A simple impact device was used to determine shell strength, for correlation with results of specific gravity determinations.

Eggs were obtained from three strains of domestic fowl: White Leghorn, Australorp, and Synthetic (a closed population, in its eighth generation, originally based on White Leghorn-Australorp crosses).

The total of eggs examined in 1 hour by suspension weighing, salt solutions, and the impact devices, was 400, 200, and 100 respectively. Repeatabilities of specific gravity, based on three eggs per hen, were slightly higher for suspension-weighing than for salt solutions. Correlations between specific gravity and breaking-strength ranged from +0.72 to +0.78 for the three strains. Correlations between egg weight and specific gravity, and between egg weight and breaking strength, were effectively zero.

The conclusion was that for routine work, the measurement of specific gravity by suspension weighing is a reliable, rapid method of estimating shell strength.

Muscle Mitochondria of Chickens with Inherent Muscular Dystrophy

The mitochondria of dystrophic muscle were studied (post-graduate research done at the University of British Columbia, Canada) to obtain data which may reveal the primary biochemical lesion of the disease. A method of isolating mitochondria from dystrophic muscle was developed and several studies of the biochemical integrity of isolated mitochondria were carried out. The mitochondria of dystrophic muscle appeared to be more easily damaged and the membranes more permeable than those of normal muscle.

Studies of the lipid composition of dystrophic muscle mitochondria revealed aberrations which may account for some of their properties. It appears most likely that the extensive tissue degradation associated with muscular dystrophy results in a build up of carbon chain fragments in the muscle, which are used for fatty acid synthesis. The fatty acids synthesised appear to dilute the essential fatty acid pool and alter the lipids of the mitochondria in a deleterious manner. The primary biochemical lesion is not evident, however.

Influence of Turkey Stocking Rate on Growth and Feed Efficiency

Male and female Australian White turkeys were separately grown on deep litter under five stocking densities: 1.5, 2.0, 3.0, 4.0, and 5.0 sq ft per bird. Increasing the stocking rate tended to depress individual body-weight gain in both sexes, and significantly increased the amount of feed required to produce 1 pound of liveweight.

On a pen basis, greater crowding resulted in greater overall profit since the adverse changes in growth, feed conversion and mortality at high densities were unimportant compared with the greater number of marketable birds. If the females had been slaughtered at 16 weeks of age, biological performance would have been sufficiently good at higher densities to give an economic response similar to that of males. The consequence of overall uneconomic growth after 16 weeks of age was that heavier stocking produced greater opportunity for monetary loss.

DAIRY CATTLE RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Feed-Year Production Trial

This 2-year period was completed. Two pastures were used; namely 24 acres of mixed *Glycine javanica*-kikuyu grass (improved), and 24 acres of unimproved grass (control).

Eighteen cows grazed the improved pasture, nine receiving also a ration of concentrates (crushed oats). The control paddocks were grazed by ten cows. The animals on the improved pasture calved during summer. Those on the control pasture calved during spring.

Concentrate feeding increased the amount of butterfat and milk produced from each cow by 39 per cent. The production per acre from the improved system exceeded that from the control system by 96 per cent.

Spring vs Summer Calved Cows Grazing Tropical Legume-based Pastures

Glycine javanica/Vetch Pastures.—This part of the experiment was conducted on two farmlets, each of 14 acres. Ten summer-calved cows grazed one farmlet, and ten spring-calved cows grazed the other; on a year-round basis.

There was virtually no difference in butterfat production between calving systems, for either the 1965–66 or the 1966–67 lactation. However, the lactation curves over these two lactations were quite different. That of the summer-calved cows reached a higher early peak, but fell below that of spring-calved cows in the later stages of the lactation. In the 1967–68 lactation there was a production difference between calving times. But this could be attributed to the particularly poor season (rainfall over the summer and autumn was 40 per cent below average).

Tropical Legume/Grass Pasture, Fertilized with Nitrogen.—Ten spring and ten summer-calved cows, each grazed on one of two farmlets (of about 14 acres) on a year-round basis.

There was little production difference between calving times in the 1966–67 lactation. In the 1967–68 lactation there was a difference (as in the preceding note) in favour of the spring-calved cows. But again this could be attributed to the particularly poor season.

Milk Yield from Nitrogen Topdressed Grass Pasture

Butterfat production was compared for cows grazing nitrogen-fertilized (300 lb nitrogen per annum) kikuyu at three stocking-rates, viz.: 2.00, 1.33, and 1.00 per acre. At the high stocking-rate an extra treatment was included to examine the effect of crushed-oat feeding designed to carry cows over the dry spring and early summer. The experiment was done over two lactations.

The results showed with increased stocking rate an increased butterfat production per acre but reduced butterfat production per cow. Supplementary feeding of the high stocking-rate increased production by 15 to 20 per cent.

Dairy Beef Production

This new project was designed to study the multiple suckling of crossbred calves on dairy cows, to determine the feasibility of rearing surplus "bobby" calves for baby beef, veal, or vealer production. Preliminary results have been promising.

PIG RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Protein Quality in Pig Rations

The value of meat meal as a sole protein supplement to different grain diets was examined. Meat meal was found to be satisfactory if used in combination with barley, oats, or wheat. Corn/meat meal diets were found to be unsatisfactory, due to development of a severe tryptophan and lysine deficiency. A sorghum/meat meal diet was found to be marginal in quality, possibly due to a lysine deficiency. The results indicated that meat meal is a suitable source of supplementary protein for barley, oats, and wheat diets but not for corn or sorghum-based diets.

BEEF CATTLE RESEARCH—GRAFTON AGRICULTURAL RESEARCH STATION

Effect of Nutrition on Reproductive Performance

This trial aimed to measure the effect of different levels of pasture nutrition on the ability of lactating first-calf cows to conceive during a 9 week joining period starting 12 months after previous joining. Results are not to hand yet.

Phosphorus Status of Beef Cattle

Eighteen preliminary, bone biopsy samples for analysis for phosphorus content were taken from seventy steers, placed on poor natural pasture. The experiment involves further analysis after 6 months, followed by phosphorus supplementation for half the group. This work is associated with phosphorus metabolism studies being undertaken by the CSIRO Division of Animal Physiology.

Livestock Production—Field Activities

SHEEP AND WOOL SECTION

Staff

Three training positions were filled. An officer was also appointed as a supernumerary and subsequently to a vacancy. Two officers were transferred to other Divisions. Establishment strength of the Section as at 30th June, 1969, was fifty-three officers; including one seconded as Manager, Trangie Agricultural Research Station, one to National Parks and Wildlife, and one as Cloud Seeding Officer, Division of Plant Industry, also one in National Service and one studying in the School of Veterinary Science, University of Sydney.

In-Service Training

Five officers of the Section attended the Commonwealth Sheep and Wool Extension Officers' Refresher Course, five attended the Departmental Extension Methods School, and four the Departmental Farm Management Course.

One officer partook in-service training with experienced District officers before being appointed to a District.

Theme of the annual seminar for Livestock Officers (Sheep and Wool) was "Genetic Influence on Efficiency of Ovine Productivity". Addresses were given by officers of the CSIRO Division of Animal Genetics, and by Department of Agricultural research and extension officers. Bureau of Agricultural Economics and Bureau of Census and Statistics officers attended and participated in syndicate discussions.

Extension Service

Weaning Weight Service.—A computerized weaning weight service was introduced. Opportunity for its implementation before the close of the year was limited, but considerable interest has been shown by breeders of meat producing sheep. Manual calculators have been ordered for each District officer.

Overall Activities.—The break of the drought increased the demands on officers. Graziers know the need for closer attention to farm management principles and improved technologies to achieve and consolidate post-drought recovery.

Use of demonstration projects, mass and group media continued to develop, though fewer field days were held than last year. The immediately following tabulation summarizes the types and number of demonstration projects, compared with those of 1967-68:

Subject	Demonstrations	
	1967-68	1968-69
Stocking management and pasture utilization	25	23
Drought and supplementary feeding	5	1
Fertility studies	15	35
Selection programmes and growth rates	29	27
Mating of ewe lambs	8	5
Nutritional studies	5	13
General management	25	14
Lifetime performance: twin vs single	8	7
Blowfly tolerance to insecticides (1969)	..	11
Breeding	..	12
Time of lambing	..	5
Totals	120	153

The next tabulation summarizes the overall extension activities of officers of the Sheep and Wool Section and provides comparisons with two preceding years:

Type of extension activity	1966-67	1967-68	1968-69	Percentage increase or decrease
Property visits	2,856	2,739	3,447	+ 25.2%
Co-operative field demonstrations ..	100	120	153	+ 25.7%
Field days and lectures	298	362	302	- 13.0%
Radio, press and TV presentations ..	459	543	791	+ 45.1%
Weaning weight service	..	..	14	..
Surveys	..	..	8	..

Effect of Extension Programme Planning

The year was the first wherein extension programme planning operated for a full 12 months. Valuable experience was gained in the methods of planning and the assessment of results. Some revision in objectives was necessary, due partly to experience and partly to seasonal, enterprise, or financial changes.

Some variations involved reorientation of the aims within a particular objective. Others required an additional objective or the integration of several facets within an objective. For example, the goal of increased wool production per head of sheep needed modification because of a marked swing by graziers in many areas to finer wools. The finer wool strains tend to lower production per head but, on present demands, mean a premium for spinning quality and a satisfactory monetary return.

Some 654 of the extension activities this year arose from the programmes—and involved demonstrations, mass media, and group activities. A near to 12 per cent increase is one of the work goals for the following year. Important in the past year has been the provision by 195 graziers of facilities on their properties for establishment of demonstration or investigational projects. The willingness of co-operators is one of the gauges of acceptance of extension objectives.

Extension programme planning has shown itself to be a very valuable tool in guiding lines of endeavour, determining strengths and weaknesses in extension activities, and for showing where guidance from the administrative personnel should be directed.

Four main extension programmes were undertaken for improved technical efficiency in the sheep industry. Each comprised a number of component programmes, not all of which were pursued in each District. The four main programmes were as follows:

Increased Reproductive Rates.—Retention of Merino ewes until fecundity declines; selection of time of joining; optimal size of lambing flock; selection for multiple birth; ram management; shearing time and its effect on reproduction; segregation of ewes into groups on lambing dates; use of drift lambing systems; effectiveness of shelter sheds to reduced peri-natal lamb losses; shearing time as it affects reproduction rate.

Efficiency in Carrying Capacity by Pasture Utilization.—Improved pasture utilization and animal nutrition; winter fodder crops; value of weaner nutrition; use of supplementary irrigation in dryland regions; efficiency in livestock production; increased stock numbers on the same area; integration of cropping with stock fodder.

Use of Scientific Methods in Sheep Selection.—Fleece measurement as an aid to selection; weaning weight grading service for sheep meat breeds; selection techniques; increasing wool production.

Improved Husbandry Standards and Techniques.—Importance of use of the Mules operation; use of Mules operation at lamb marking; efficiency in ram husbandry; efficiency in lambing practices; use of Dorset Horn/Merino cross ewes in second cross lamb production; improved management on the northern tablelands; efficiency in preparing and presenting prime lambs for market.

Production Trends in Sheep and Wool Industry

Production was this year influenced more so than in the past by wool prices, drought, and the growing appreciation of farm management principles and newer technologies.

A major trend was to the Merino because of depressed lamb prices in the previous year, and increased premium for finer rather than bolder wools. Selection of rams for finer counts was apparent, stronger woolled flocks moving to medium, and medium woolled flocks to fine wool rams.

At ram sales there were excellent clearances of the fine wool types in particular. Sales of British breed rams, Border Leicesters in particular, were depressed.

Many breeders replaced crossbred ewes, or joined ewes to rams of the wool breeds—especially Merinos. In first-cross production there was keen interest in the potential of the Dorset Horn instead of the Border Leicester, because of finer wool and ability to mate successfully in spring.

All reports indicated increasing sheep numbers. In many areas numbers had not reached the pre-drought levels, but the increase has been faster than was anticipated. There was a tendency for sheep to be grazed on smaller portions of a property at higher stocking rates than formerly. Lucerne sowing increased, directly reflecting appreciation of its value as a grazing supplement during the drought.

In most areas, most of the ewes were joined in autumn for a spring lambing. Several districts recorded 60 per cent of the ewes as joined in autumn. Autumn joining is an extension service objective that has met a good response since it was first extended about 6 years ago. At that time only 15 to 20 per cent of ewes were mated in the autumn.

There are still fairly even proportions of spring and autumn joinings for lamb production. This is desirable, to distribute lambings over the year.

The proportion of wethers in flocks fell, the emphasis turning to breeders—to provide replacements.

The increased interest in modern technologies in sheepbreeding and management is in part exemplified by the fact that commercial samples processed by the Fleece Measurement Service, Trangie Agricultural Research Station, totalled 364 more than in the previous year; making a total of 4,955 samples. Pastoralists in general are more critically analysing their enterprise, and thus increasing the opportunities for advisers to encourage improved technologies.

Another post-drought development has been the building-up of fodder reserves—most as hay, a little as silage, and some oat grain. Farming of summer fodder crops extended considerably, as cash crop and as grazing.

Private woolselling at shearing sheds has decreased. Stock sales have been brisk during 1969, and prices firm for restockers. Lambing percentages have been good, and above the average recorded for the past 3 years.

Sheep on Departmental Farms

Sheep totals on Departmental farms recovered to almost pre-drought levels, and approximated 25,000—mostly used for research.

BEEF CATTLE, HORSES, AND GOAT SECTION

Staff

Two officers resigned, six were recruited, and at the close of the year the Section's personnel totalled twenty; the Principal Livestock Officer, the Special Livestock Officer, seven District livestock officers and eleven livestock officers.



Oversowing Legumes for Beef Cattle Pastures—North Coast

For the beef cattle husbandry project near Grafton, legumes selected for this sub-tropical environment are being over-sown into the inadequate grass pasture by the rollerdrill method.

Training of Officers

The officer-development practice of posting recently appointed officers to private properties in Northern Australia was continued. Three officers returned in 1968 from such posting, and four started there early in 1969. The effect of this training on officers in the early years of their Departmental employment has encouraged its continuation. Since the practice was started in 1959, eighteen officers in early years of their service have partaken it.

Extension Services

Regional Staffing.—Seven of the nine Agricultural Regions had the services of livestock officers of this Section. During the coming financial year all Regions may be so staffed. After that, by subdivision of areas of responsibility, there will be additional beef cattle extension services.

Activity Statistics.—A statistical summary of the Section's extension activities is provided by the following: 1,025 farm visits, 77 field days serviced, ten lectures/demonstrations other than at field days or schools, 17 gatherings for Beef Cattle Breeders' Competition purposes, 36 short schools serviced by talks, 46 meetings attended, 13 officiations at Agricultural Shows, 86 radio releases, 87 press releases, 72 livestock sales attended.

Effect of Programming.—Each officer had programmed extension goals. Concentration was on extension of the selection of breeding stock—based on recorded rate of gain by young cattle.

Beef Cattle Breeders' Competition.—The competition sponsored by the Agricultural Bureau of N.S.W., the Rural Bank of N.S.W., and this Department was judged by this Section for the 17th successive year.

Competitive Exhibition of Stock

Exhibition of stud cattle by the Department at the Sydney Royal Show was continued, but considerably reduced. The Angus, Poll Shorthorn, and Poll Hereford studs are deeply involved in herd improvement schemes considered more important than is outstanding excellence in a few individuals.

The Department's Arabs maintained their pre-eminence at the Sydney Royal Show; among them the Arab stallion "Delos"—Supreme Champion for the third successive year, and "Sphynx"—the Champion Arab Mare.

Production Trends in Beef Industry

Transformation of the pastoral situation in New South Wales by the soaking rains during recent months led to influx of beef cattle from Queensland in record numbers.

American interest in beef cattle production in New South Wales has increased. So much of the more attractive grazing country is tightly held that newcomers are obliged to take on what may be termed second-class country. This is to the State's advantage. Already, there has been a large in-flow of U.S.A. capital into development of such coastal areas for beef cattle industry.

PIG SECTION

Staff

Two livestock officers resigned, one to undertake a university course, the other to take over his own property; and another transferred to the Research Section. Three livestock officers were appointed and at the close of the year the establishment comprised seventeen positions: the Principal Livestock Officer, five Senior livestock officers, ten livestock officers, and one position vacant.

A Livestock Officer (Pigs) was appointed to the Mid Western Region, with headquarters at Parkes, previously serviced from the Western Region.

In-Service Training

Training of junior officers at the Colleges and Research Stations continued. They attended, also, the School for Pig Raisers for training and visited District livestock officers (pig) for field experience.

Three District livestock officers of the Section attended the Refresher Course in Pig Production organized by the Animal Production Committee and held at the University of Melbourne Field Station.

Extension and Regulatory Services

Activity Statistics.—The activities of officers of this section are summarized, with previous years' comparisons, in the following table:

	1965-66	1966-67	1967-68	1968-69
Farm visits	1,564	1,461	1,844	1,734
Meetings	68	71	85	119
Pig sales attended	150	114	121	105
Field days attended	32	19	35	39
Bacon factory and abattoir visits	66	44	51	59
College and Research Station visits	74	51	57	67
Shows attended	17	16	28	26
Lectures and demonstrations provided	84	104	87	136
Swine Branding Act inspections	19	22	27	27
Stock Food and Medicine Act inspections	17	32	12	42
Publicity statements (press)	113	76	116	105
Radio and television segments	113	83	126	139

Individual Contacts.—Due to reduced pig meat prices, the number of inquiries reflecting people wishing to enter the industry fell away. However, all extension officers handled a constant stream of requests from pig producers for advice—through personal interviews and by letter and by telephone.

In three Regions, a livestock officer of this Section acted as Officer-in-Charge in the absence of the respective Regional Supervisor.

Annual H.A.C. School for Pig Raisers.—This drew eighty applications but, as usual, attendance was restricted to forty. Many parts of the State were represented.

Effect of Extension Programming.—All extension officers of the Section engaged in programmed extension. The set objectives included: Improved pig accommodation; improved pig nutrition; improved pig management; use of pure-bred boars; control of internal and external parasites; machinery in the piggery; and revision of Departmental literature affecting pig industry.

The intended effect of these objectives was to lift the efficiency rather than increase production of pig industry. The latter was already at danger level. Some of the work-effects of the programme planning were the conduct of seven decentralized schools for pigraisers, more attention to radio, television, and the press as extension channels, and an interesting survey done in the Southern Region to provide very useful information on pig production there.

Assistance to Other Departments and Organizations.—Technical advice was given in the management of pig herds maintained at institutions controlled by the Departments of Correction, Health, Education, and Child Welfare. The institutions were supplied with brood stock as required. The Department of Technical Education was provided, also, with a part-time teacher in the correspondence course in Pig Raising.

The services of officers were called on by farmers' organizations, the Rural Youth Movement, the Australian Pig Society, the Royal Agricultural Society of N.S.W., numerous country show societies, and the Rural and Commonwealth Development Banks.

Pig Industry Production

Pig production reached record levels. This followed the record total of 99,000 brood sows in production as at 31st March, 1968. For the first year in the history of New South Wales pig industry more than a million pigs were slaughtered.

Pig meat production increased only 12 per cent on the 1967-68 level, but this was the result of producers continuing to sell a high proportion of their pigs at the lighter weights for consumption as fresh pork. Bacon and ham production was affected by this practice and fell by about 3 per cent compared to that of 1967-68.

Consumption of pig meats remained at satisfactory levels. Bacon and ham supplies were sufficient to meet demand. Pork consumption was affected early in the year by lowered lamb prices but, as the lamb prices improved, pork consumption regained its previous level.

The fall in lamb prices financially embarrassed many pig producers—especially those using highly priced meals—and caused some to cease production. Generally, price structure was satisfactory as regards “top” prices but—with the high total of pigs being marketed—the lower prices weakened considerably; buyers able to be selective in their purchasing. The porker market was the most seriously affected. It experienced the lowest prices paid in the past five years.

Activities Under the Swine Compensation Act

The Section assisted in the preparation, examination and processing of claims for compensation for pigs destroyed and carcasses condemned on account of scheduled diseases. The position of the Swine Compensation Fund as at 30th June, 1969, is reported in the Appendix covering the Accounts of the Department.

Activities Under the Swine Branding Act, 1940

New brands issued totalled 1,208, and twenty-four licences were issued. Revision of the Swine Brand Register progressed. Sufficient cancellations of unused brands became available for re-issue to new applicants. The revision also showed brands in use by persons other than the registered person. Considerable work was entailed in organizing the transfer of these brands (690) to current users.

The Departmental Herds

Large White, Landrace, Berkshire and Tamworth breeds were maintained; at Hawkesbury College, Wagga College and the Grafton and Wollongbar Agricultural Research Stations. At Hawkesbury and Wagga they were mainly for instruction purposes, and rations. The Wollongbar and Grafton herds were used for research, nutritional and dissection studies.

New blood lines were introduced to the herds at Hawkesbury, Wollongbar and Wagga. A programme of culling aged and unsatisfactory brood stock continued.

In all, 1,497 pigs were disposed of; by sales of stud animals and market pigs, as ration pigs at the colleges, and as pigs killed for research. Three hospitals were supplied with pigs for liver perfusion and organ transplant work.

POULTRY SECTION

Staff

The Section's establishment was increased to twelve by a “Livestock Officer (Poultry)—in training” position. One officer returned from National Service and subsequently resigned. Two officers appointed brought the Section to full strength.

New appointments were made—to the Gosford District, the Mid Coast and Hunter Region, and the Parramatta District—as officers completed in-service training. The one established District vacant at 30th June, 1969, was Southern.

Training of Officers

For the two officers who completed their initial training programmes and were appointed to District positions, the experience on commercial hatcheries, broiler farms and layer units continued to prove an invaluable phase of in-service training. Two others were still in this training at 30th June, 1969.

A Commonwealth Poultry Officers Refresher Course, held at the Queensland Agricultural College, was attended by six officers from this Section. They participated in the presentation of material and in discussion sessions.

Four officers of the Section attended also the Australasian Poultry Science Convention organized by the Australian Sub-Branch, World's Poultry Science Association. Three of them presented technical papers, and the Principal Livestock Officer participated in the organization and conduct of the convention.

Extension Service

Activity Statistics.—The Section's extension activities for the year are summarized in the following:

Farms and hatcheries visited	746
Field days and demonstrations serviced	30
Visits to manufacturers	82
Meetings attended for service	46
Articles for rural and industry press	25
Radio broadcasts	14
Lectures and symposia	49
Courses organized	1

The Poultry Farmers' School.—The changing character of the poultry industry led to re-organization of this school, to provide more specialized technical information to servicemen, technicians and commercial producers. A 5-day course attended by seventy people from the industry was successfully conducted.

The Turkey Raisers' School.—This was cancelled because of insufficient applications; the first break in continuity of turkey schools for 16 years. This reflected the changing structure of the industry, with fewer farms, employing large scale intensive methods.

The Annual Poultry Farmers' Field Day.—This, at Hawkesbury Agricultural College, was again a major occasion. It drew more than 800 people from the industry. The proportion of commercial producers attending increased notably. Keen interest was shown in high quality displays by forty-five companies. Many displays featured aspects of the theme “Control of the Environment”. The Department's Poultry Section conducted a display suiting that theme, and also provided the Information Centre.

Effect of Extension Programming.—The initial appointments of three officers to their Districts, and the transfer of another officer to a new District did not permit full exploitation of programmed extension this year, but all officers undertook a *situation analysis* basic to a future programme. Progress was also made in respect of housing for layers and meat chickens, and artificial lighting for poultry.

Specialist on Poultry Meat Production.—Liaison between officers and poultry meat producers increased as a result of an officer specializing in poultry meat production. Development of controlled-environment housing for meat chickens has been of special value to commercial producers. The Poultry Section played a leading role in the design and operation of fifteen such houses.

Pullet Replacement Practices Surveyed.—This survey was planned as a situation analysis. It revealed great variation in methods and standards of rearing replacement-pullets. The results were published in “Poultry Notes”, and presented also at industry meetings and through other extension channels.

Broiler Industry Survey.—This survey was conducted by the Division of Animal Industry and Division of Marketing and Agricultural Economics, to secure firm data on the economics of broiler production, and factors influencing returns to producers. Analyses were not complete at 30th June, 1969, but preliminary information has been valuable to extension officers and producers.

The survey revealed a wide range of economic conditions, demonstrated the trend towards increased returns with increased scale of operation, and highlighted areas that require further study on individual farms.

“Poultry Notes” Mailing List Revised.—The mailing list was revised to delete obsolete addresses and to ensure that the increasing amount of technical material contained in the notes was directed mainly to commercial producers. Quarterly publication of “Poultry Notes” was maintained.

Colombo Plan Group Course

The Department of External Affairs liaised with Departments of Agriculture in four States to conduct a Group Poultry Husbandry Course for Colombo Plan Fellows. The course was of twelve weeks' duration. Six of the weeks were spent in New South Wales. Officers of the Poultry Section participated in organizing the course and in the presentation of lectures, demonstrations and discussions. Eleven Colombo Plan Fellows attended the course.

Random Sample Layer and Pure Breeds Tests

The 16th Random Sample Layer Test and the 7th Pure Breeds Test were conducted at Hawkesbury Agricultural College. The Random Sample Layer Test was supported by nineteen commercial breeders and provided the only objective comparison between locally available strains of poultry. Four pure breeds of poultry were tested, from 11 entrants in the Pure Breeds Test. The conduct and management practices in this Test were modified to provide a demonstration of suitable commercial production methods.

Legislation—The Poultry Processing Act (1969)

A main purpose of this Act of Parliament is to limit the amount of water retained in poultry carcasses during processing.

Poultry Industry Production Trends

Layer Industry.—Egg production continued at a high level: 1.8 per cent higher than in 1967–68. Returns to producers (34.4 cents per dozen at 30th June, 1969, after payment of Egg Marketing Board charges and hen levy) were also higher than for 1967–68 (30.4 cents). Returns were favourably influenced by a reimbursement of surplus Central Egg Marketing Authority funds from previous years. The hen levy was maintained at \$1.00 per bird per year.

Hatchings of replacement pullets (3,562,000) were lower during the first half of 1968–69 than in the corresponding period of last year but significantly increased during the second 6 months. The total pullet hatch was 6,197,000, a thousand more than in the previous year. About 12 per cent of the replacement pullets were sold as started-stock. Price of culled hens remained low (9–10 cents per lb liveweight). Some hatcheries guaranteed the re-purchase of layer stock after completion of the laying period.

A Sub-committee of the New South Wales Poultry Advisory Board studied proposals for stabilizing the egg producing industry. A stabilization plan was subsequently referred to the industry for consideration.

The trend towards increased farm size continued. Statistics released by the Egg Marketing Board showed a decrease of 568 in the total of registered producers, to 2,746.

Meat Industry.—The following table enables comparisons, for the past 3 years, of statistics of poultry slaughter for human consumption. Figures for the 1968–69 line are accurate to May, 1969, but June production was estimated to complete the 12 months.

* Poultry slaughtered

Year (July to June)	Chickens	Ducks	Turkeys
1966–67	32,113,000	306,000	441,000
1967–68	36,556,000	335,000	483,000
1968–69	35,102,000	536,000	679,000

* N.S.W. Government Statistician.

The slight decrease in 1968–69 production of chickens, compared with the previous year, was due to the large build up of cold-stored poultry. Less chickens were hatched and some broiler producers left the industry. Increases in duck and turkey production during 1968–69 were notable.

After discussions between Ministers for Agriculture, processors and growers representatives, returns to broiler producers improved. Some of the improvement could be attributed to better strains of chickens, and feed quality. However, there was later a reduction of half a cent in the liveweight price of chickens (which had averaged about 20 cents), and also the price of all broiler feeds increased by from \$3.00 to \$5.00 per ton. These changes are expected to affect future returns to producers.

Integration developed in the turkey industry. It can be expected that most turkey production in N.S.W. will be by a form of integration. Turkeys were in fairly short supply at Christmas and prices were firm.

There was also evidence of duck industry integration. Demand for the heavier Muscovy breed increased and there was a 3 cent per lb liveweight premium over "English" breeds.

With all poultry meat birds, the trend was towards improved housing. Many smaller producers left the industry, while larger producers tended to increase flock capacities.

APICULTURE SECTION

Staff

There was no resignation or transfer. One appointment was made, to a newly established position.

Equipment for Officers

A need to equip District officers with microscopes, refractometers, honey colour graders and other items to assist investigations and extension programmes has been given attention. Some of the equipment was obtained this year and further requisitions have been raised.

To further assist extension officers, and to enable additional research, a specially designed mobile extracting van with research laboratory annexe has been built. It is currently being equipped with custom-built extracting and refining equipment.

Extension Activities

Apiary officers through various media encouraged the adoption of sound bee husbandry and honey refining methods. Emphasis was on increased mechanisation, and improvement of honey quality. Extensive use was made of meetings, field days, radio, press and television. Apiaries and farms were visited.

An increasing number of enquiries concerned pollination.

Officers investigated several reports alleging that bees constituted a nuisance. An amicable settlement was mostly arranged.

Beekeepers' Field Day.—This was a highlight, held at Inverell in co-operation with the Inverell and District Apiaries Association. It drew 200 apiarists. Many of them came from interstate to assess the merits of various hive loaders especially assembled there.

Annual Beekeepers' School.—Held again at Hawkesbury Agricultural College, this was very successful despite the unfavourable season.

Honey Production

For most beekeepers, this was probably the worst season in the last 20 years. After a good season in the previous year beekeepers thought of an average crop, but drought and fires and generally unfavourable spring and early summer weather seriously affected nectar secretion and bee activity. Plagues of thrips, amongst the worst ever, caused a complete failure of ground flora throughout the State. In the western districts, Rutherglen bugs were also in plague proportions.

Green Mallee, which drew a particularly heavy concentration of hives, was virtually a failure. Dry conditions caused a failure of the iron-bark on the central and south coasts, and bush fires caused loss of many hives.

The main area of production was the north coast, where there were satisfactory crops of brush box, spotted gum and tea-tree.

Near-record production in the previous year, and a poor demand for export, caused considerable carry over of honey. Honey prices for most of the year were generally unsatisfactory to the beekeeper, in view of rising costs. Only towards the close of the year, with depletion of accumulated honey stocks, did price to the producer rise appreciably. Much honey was exported to other States early in the year.

Bee Diseases

Incidence of American foul brood (*Bacillus larvae*) was relatively low, despite a slight increase in total of outbreaks compared with a year earlier. With one exception, all outbreaks were controlled. In all, only a few hives were infected.

Nosema disease was in most hives in a chronic form. Because it can result in heavy mortality in adult bees and may cause loss of colonies, special attention has been paid to examination of bees in the field—and to recommending practices to minimise losses.

The Department's Apiaries

Production Affected.—Unfavourable seasonal conditions in the Hawkesbury district adversely affected the Department's main apiary. Hives were therefore moved to other districts.

Queen Bee Breeding.—The number of queen bees made available to commercial queen breeders and apiarists from Hawkesbury Agricultural College apiary was less than in the last 2 years, but some progress was made in breeding.

While overseas in 1967, the Principal Livestock Officer (Apiculture) investigated the availability of stock suitable for local conditions, and assessed risks associated with importing queen bees from the U.S.S.R., Austria, Italy, France, Germany, the U.K., and U.S.A. His recommendations were accepted by the various State apiculturists and by the Federal quarantine authorities.

A double-walled quarantine cage has been specially built at the Division of Science Services, Rydalmere, to accommodate stock imported from countries where certain diseases not present in Australia have been reported—but where the apiaries from which the bees originated were found to be free of the disease.

A consignment of queen bees from the U.S.S.R. and addressed to a New South Wales apiarist was received. With the approval of the Commonwealth Department of Health and the consent of the consignee, the queen bees were used to develop the same genetic material here—for comparison with existing strains of Caucasian bees, and possible incorporation in future bee breeding projects. Because of existing quarantine regulations queen bees cannot be imported from Europe by beekeepers.

The Department plans to make importations from Austria, Yugoslavia, and Italy to develop breeding stock for release to queen breeders and commercial apiarists mainly in New South Wales but also in other States.

Honey Board Research Grants

Since the formation of the Australian Honey Board in 1963, a Honey Research Fund has been established. The grant amounts to \$10,000 per annum and has been used to promote Departmental research, to equip Departmental apiaries and to enable special investigations to be made.

Liaison with Other Organizations

CSIRO.—The Apiculture Section liaised with the CSIRO Division of Food Preservation and supplied information concerning the industry, areas and methods of production, and the relative significance of the main honey producing species. CSIRO specialist officers were taken to areas of production and supplied with honey from numerous floral species.

Australian National University Lectures.—The Principal Livestock Officer (Apiculture) and another officer delivered a series of lectures to forestry students at the Australian National University, Canberra, at the request of the Chairman of the Australian Honey Board. The lectures developed closer liaison between apiarists, foresters, and Departmental apiary officers.

Codex Alimentarius.—This Department's recommendations were adopted concerning honey standards set for Europe on a regional basis by Codex Alimentarius (FAO and WHO establishment of food standards on regional or world basis). The Department's proposal regarding inclusion of creamed honey was also accepted.

Interstate Movement Certificates.—With amendments to Apiaries Acts in Victoria and South Australia, certificates must now be issued for all honey and bees moving from New South Wales into the Australian Capital Territory and all mainland States. Considerable work has been involved in preparation of appropriate certificates and in the necessary preliminary inspections.

Certificates are requirements also for export of bees to countries overseas and for honey to certain countries.

Imported Bees—Quarantine

Apiculture officers assisted with quarantine procedures concerning queen bees from countries such as the U.S.A. and Canada. After providing new cages and fresh escort bees, the imported breeding stock were forwarded to local queen raisers, when examinations and certificates proved satisfactory. Except for scientific purposes, and subject to special approval by the Commonwealth Department of Health, importation of bees from countries with internal mites (*Acarapis woodi internus*) is prohibited.

Pastures Protection Section

STAFF

Except for more rabbit inspectors (eighty-one in 1968–69 as against seventy-three in the preceding year) the Pastures Protection Boards' staff numbers this year were as in 1967–68; viz., thirty-three veterinary inspectors, sixty-five rangers, and fifty-eight Pastures Protection Board secretaries.

In-Service Training

Rabbit Control Schools, etc.—Two schools on the handling and mixing of "1080" poison and general rabbit control were conducted; one in the Armidale District and the other in the Albury District.

Arrangements have been made for the second Refresher Course for Rabbit Inspectors to be held at Hawkesbury Agricultural College in September, 1969. Attendance will be restricted to those inspectors who have not previously attended a refresher course, and who have completed at least 12 months service with a Pastures Protection Board after having attended a Rabbit Control School.

Arrangements have been made also for a symposium, for Pastures Protection Boards Directors—to give them details of the training and instruction imparted to rabbit inspectors, and to develop their clear understanding of Director duties and responsibilities.

*Plague Locust (*Chortoicetes terminifera*) Control*

Hatchings occurred in the central western districts in the early spring, although the resulting locusts did not comprise a threat. Following subsequent egg laying and hatching, an extensive infestation occurred over a wide area of the central west. But the insects did not migrate from the hatching grounds. Consequently very little treatment was required by the field officers.

Due to the late onset of winter, locusts were active longer and there was extensive egg laying during late autumn.

There is more detail in the Entomological Branch, Division of Science Services, section of this Report of the Department.

Revocations of Travelling Stock Reserves

Applications are being dealt with expeditiously. The only ones not finalized are those whereon replies from Pastures Protection Boards are awaited.

Pastures Protection Act Amendments

Cabinet has approved the introduction of a bill to amend sections of the Pastures Protection Act in accordance with various recommendations made by Pastures Protection Boards through their annual conferences; also suggestions initiated by the Department and agreed with by the Boards.

Tail Tag Identification of Cattle

Following implementation of the regulations to the Stock Diseases Act requiring that sale cattle be identified by a tail tag, application forms for particulars of identification or a licence have been received in considerable volume. Issue of certificates will proceed shortly, as soon as the printed material is to hand.

DIVISION OF DAIRYING

General

THE DIVISION'S ROLE

The Dairy Industry begins at the dairy farm with the growth of pastures and other feeding-stuffs, the breeding, management, nutrition and health of the dairy stock, and the production and handling of milk. Thereafter it is concerned with transport and distribution of milk, with dairy products manufacture and with the machinery for these essential services. Throughout, the industry is deeply concerned with the quality and nutritive value of milk and the products.

The Division of Dairying role is to guide the industry in all phases from farm production to the quality processing and marketing of the end products.

STAFF

Administrative Professional Staff Changes

Four Assistant Principal Dairy Officers were appointed: former Lismore District Dairy Officer, Mr L. G. Boucher—Assistant Principal Dairy Officer (Extension); former Senior Livestock Officer (Dairy Cattle), Mr R. L. R. Auld—Assistant Principal Dairy Officer (Herd Improvement); former Windsor District Dairy Officer, Mr B. P. Mullins—Assistant Principal Dairy Officer (Milk Products Other than Butter); former Bega District Dairy Officer, Mr G. E. Kent—Assistant Principal Dairy Officer (Butter). Also, former Senior Dairy Officer (Research), Mr B. O. E. Calder is now Assistant Principal Dairy Officer (Research), and has been Acting Principal Dairy Officer (Research) since Mr F. W. Marriner transferred from this position to that of Chief Lecturer in Dairy Technology at Hawkesbury Agricultural College.

Changes in Dairy Officer Districts

The Windsor Dairy District now includes the former Orange Dairy District. The Orange District Dairy Officer position has been transferred to a new Dairy District Officer position at Casino. Casino was formerly a sub-District, operated from the Lismore Dairy District office. The Tamworth Dairy District position has been transferred to Muswellbrook. Muswellbrook was formerly a sub-District of the Maitland Dairy District. These moves were made for better use of staff, in view of the decreased dairying activities in the Orange and Tamworth Districts.

Livestock Officer Staff Position Improved

Four new Livestock Officer (Dairy Cattle) positions have been created, including three "In-Training" positions. The three "In-Training" positions will facilitate the development of young officers to fill positions in the Division's establishment as vacancies or new positions occur. The fourth position is that of Livestock Officer (Dairy Cattle) for the Herd Improvement Section at head office—the first increase in this Section's head office personnel since 1947.

INDUSTRY TRENDS

Adverse Seasonal Conditions for Production

Rainfall was insufficient for dairying on the north and south coast during the winter, spring and summer months. There was some relief in the summer months but drought conditions persisted until the autumn of 1969. Substantial supplementary feeding was practised. Availability of cheap grain helped farmers. Gift fodder was despatched from inland areas to aid drought-stricken south coast farmers.

Further to the improvement in the autumn, the conditions for dairying at the end of June, 1969, were the best for several years past.

Fewer Dairy Farms; Fewer Cows

The total of registered dairy farms supplying to factories and milk depots in N.S.W. continued to fall and has reached 9,672; through a decrease of 1,366 since the 1967-68 Report. Of this decrease, 312 were from Milk Board areas and 1,054 suppliers from outer areas. The continuing cost/price squeeze, and drought, have contributed to the decrease in the outer areas; quota effects and urban development have contributed in the Milk Board areas.

The 9,672 suppliers include 107 who supply from other States to N.S.W. factories or milk depots. The 9,762 comprise 5,885 milk suppliers, 2,875 cream suppliers, and 912 milk and cream suppliers. Of further interest, 476 of the N.S.W. dairy farms supply to other States—248 supplying milk and 228 supplying cream.

The total of cows (in milk and dry) continued to fall. This year it fell to 731,358, as against 760,179 a year earlier.

In contrast to the trend in recent years, the fall in cow total was accompanied by a fall in milk production but there were associated unfavourable seasonal conditions. Milk production was 271,913,000 gals, as against 318,973,000 in the previous 12 months.

N.S.W. Milk Production and Usage Statistics for the 12 months Ended 31st March, 1969

	Amount
Total Milk Production	271,913,000 gals
Consumed as whole milk (in Board area)	101,577,200 gals
Consumed as whole milk (outside Board area)	33,184,000 gals
Butter	51,291,505 lb
	(From "Form 20" returns.)
Cheddar Cheese	9,245,369 lb
Cheese other than Cheddar (including Cottage and Ricotta)	Figures not available.
Milk Powders	70,584,000 lb
Condensory Products	28,062,000 lb
Ice Cream and frozen milk products	20,003,000 gals
	(Figures from ice cream manufacturers.)
Casein	Figures not available.
Yoghurt	1,200,000 gals
	(Estimated from manufacturers figures.)
Number of suppliers to factories	9,672

The decline in wholemilk production from 318,973,000 gals in the 12 months to 31st March, 1968, to 271,913,000 gals in the 12 months to 31st March, 1969, is reflected by the big drop in butter production from the 1968 total of 75,380,156 lb to 51,291,505 lb. This necessitated wide use of interstate butters for the print trade. Some quality problems were experienced in the use of the interstate butters and some were returned to the suppliers or diverted to alternate uses.

Effects on Dairy Factories

The effects of the cost/price squeeze on farms have also been felt by dairy factories. In Milk Zone areas the reduction in suppliers has caused a greater reduction in availability of manufacturing-milk since quotas have been purchased from those leaving the industry and this quota milk has largely replaced previous manufacturing-milk.

Because of the considerable capital invested in factory buildings and equipment, the developing situation is obliging dairy companies to investigate alternative procedures and uses, e.g.:

- bulk collection of milk, and factory amalgamations;
- manufacture of recombined products;
- manufacture of general food industry products, where Dairy Industry Act Regulations allow;
- streamlining of procedures.

Factories are increasingly using bulk collection and large silo vats for milk storage. With manufacturing-milk stored in the vats, weekend work and consequent penalty rates of pay have been largely eliminated in some factories. Provision of sufficient storage to carry the milk over the weekend has allowed better distribution of work over the 5-day working week.

Changeover from Cans to Bulk Collection of Milk

Installation of farm refrigerated milk tanks has continued at a rate almost as fast as the tanks are available. There are now 2,370 farms with bulk milk vats. Milk quality has generally improved as a result of farm refrigeration, but constant checking of milk quality is maintained.

Increased interest in changeover to bulk milk collection was influenced this year by availability of Government guarantees for loans to dairy companies for this purpose. Enquiries were received from ten dairy companies, and four of these followed up with applications examined by a Department of Agriculture Committee. One of the four companies later withdrew due to the conditions of the guarantees, and one other has applied for a further guarantee.

The Treasury has approved the guarantees to the three effective applicant companies. The seven other of the ten enquiring companies have continued with introduction of bulk collection—having obtained satisfactory finance without use of the Government guarantee. Some of the seven are close to 100 per cent changeover, whilst others have indicated possible interest in a guarantee for final stages of their scheme.

The guarantee document has a standard clause providing that during the currency of the guarantee the Co-operative will where reasonably practicable utilize the services of the New South Wales Government Railways in preference to other forms of transport, so far as the carriage of goods and produce relating to the operations of the Co-operative are concerned.

DAIRY INDUSTRY ADVISORY COUNCIL

The Council submitted its report to the Minister for Agriculture in February, 1969. The report aims at unification and strengthening of the dairy industry and is under consideration by the Minister and State Cabinet.

NORTH COAST DAIRY FARM FEED-YEAR ASSISTANCE SCHEME

This Scheme commenced on 1st October, 1966, and will operate for 5 years. Its progress in each of the first 2 years, to 30th September, 1968, is summarized in the following tabulation:

	Claims	Acres treated	Average claim		Amount paid	
			per acre	per farm	By N.S.W. Govt.	By Farmers
1-10-66—30-9-67	4,945	74,383	\$ 13.69	\$ 206.05	\$ 1,018,960	\$ 647,015
1-10-67—30-9-68	3,622	61,861	10.51	179.50	650,137	650,137

In the first 12 months of the Scheme an additional \$5/acre was given to each claimant farmer to defray establishment costs. This is reflected in the higher payment by the N.S.W. Government in comparison with that of the farmer. Since that first year, the farmer has contributed a dollar for each dollar spent by the Government.

Figures available for the 9 months since 30th September, 1968, could indicate a slowing down in rate of acceptors of the Scheme; with \$53,840 paid to the end of May, 1969, as against \$77,499 for the relevant period of 1967-68. However, that might not be a continuing trend. Weather conditions during and since May, 1969, have been much more favourable than in the previous months and with this improvement came a marked increase in number of applications for assistance under the Scheme; 373 applications in May, 1969, as against 299 in April, 1969, and as against 368 in May, 1968.

MASTITIS CONTROL PROGRAMME

Co-operating Demonstration Farms.—The Mastitis Control Programme, based on recommendations of the National Expert Panel on Bovine Mastitis (1966), commenced with (at 30th June, 1969) a tentative progress total of thirty demonstration farms. The confirmed total will have reached forty during 1969-70. C.E.S.G. funds to a total of \$8,500 covered field equipment for this first year of the Programme, and \$15,000 allocated for 1969-70 will allow the increase to forty farms.

Co-operating farmers have been selected from those showing a high Modified Whiteside test score on their bulk milk at the factory, and 25-40 per cent incidence of infected quarters by the California mastitis test.

Basics of the Programme.—The programme is based on:

- correct use of milking machines, including mechanical efficiency and milking management;
- udder washing with running water before milking, and the use of a skin sanitizer;
- teat disinfection after milking (teat dipping);
- identification of infected quarters, and
- effective treatment during lactation and at drying off,
- segregation of infected cows,
- culling of chronic incurable cows.

Work-plan by N.S.W. Mastitis Co-ordination Committee.—This Committee was formed, comprising representatives from the Department of Agriculture Divisions of Animal Industry, Dairying, Science Services, and Marketing and Agricultural Economics, and the Biometrician, the N.S.W. Milk Board and the University of Sydney. The Committee has formulated an action plan for the control programme.

Schools for Officers.—Three schools were held to familiarize officers with the requirements of the programme.

Fifteen forms, with accompanying explanation sheets, have been prepared for data collection. Seventy Manuals of Instruction have been issued.

Provision for Programme Evaluation.—The programme will be evaluated at the end of 2 years; in terms of the effect of the expected reduced incidence, on production, and whether the production improvement is profitable.

FARM MILK METERS

Many attempts have been made over the years, notably since World War II, to evolve a satisfactory farm milk meter. In recent years there have been meters in use in some overseas countries, but until July, 1967, there was not available a meter considered by the British Milk Marketing Board and the New Zealand Dairy Board satisfactory for herd recording.

Milk meters provide means of measuring milk yield of cows through a representative sample; obviating the bucket-collection and weighing of the whole of the milk given. Most meters work on the principle of diverting into a flask or bottle one fortieth or fiftieth of the milk. From this a sub-sample is taken, to test for butterfat or other milk components.

Following the successful work in New Zealand, establishment of a "Meter Unit" for checking under N.S.W. conditions became imperative. The first "milk meter herd recording unit" in N.S.W. started operating in September, 1968—in the Windsor Dairying District. Three more units were established in November, 1968, and in February, 1969, three more—as C.E.S.G. demonstration units.

Now all told there are nine operating: a C.E.S.G. unit respectively in Lismore District, Taree District and East Maitland District; a Herd Production Improvement Scheme unit in Windsor District; a loan unit (from Alfa Laval) in Windsor District; and four farmer-sponsored units in Deniliquin District. For a further two in Deniliquin District the equipment is on hand.

EXPANSION OF HERD RECORDING SCHEME

Eleven more Herd Recorders and a Relief Recorder were employed this year. The expansion of establishment to 106 positions comprised the largest increase in the history of the Herd Recorder establishment.

Extension, Education and Regulatory Services

DAIRY PRODUCTS GRADINGS AND QUALITY INVESTIGATIONS

Butter

Grading Services.—The Dairy Products Grading Staff made regular examinations of butter (and cheese) manufactured by the N.S.W. factories and received at Sydney, Newcastle, Wollongong, Canberra, and Wagga for distribution and storage prior to sale on the local market. Samples from Wollongong and Canberra, and Wagga were sent to Sydney for grading. Newcastle was regularly visited for gradings. Butter stored at Casino and Lismore was examined at those centres before being cold-stored locally.

Details of the grading were sent to distributing agents, factory managers, and District dairy officers. This information is basic to the quality control and extension work of Divisional field officers.

Statistics from the butter grading were the basis also for the "Order of Merit of the N.S.W. Department of Agriculture" and the continuous Grading Competition of the Royal Agricultural Society of N.S.W.

Substantial quantities of butter (and cheese) were imported into N.S.W. from other States, mainly Victoria, to supplement local production. At the request of agents, the quality was checked by Departmental Graders before distribution.

Samples of butter representing 1,413,792 boxes were graded, whilst 5,090 samples of cheese were also examined. Other products such as butter oil, powdered milk, and margarine were examined from time to time as requested by manufacturers and distributors.

Biological and Chemical Surveys.—Butter samples were taken regularly for biological examination by the Division of Science Services and for chemical analysis by the Dairy Chemist at Hawkesbury Agricultural College. Results of these biological and chemical analyses were sent to District dairy officers and factory managers.

Special, Quality Investigations.—Special investigations into quality defects at various factories were continued. The Biological Branch, Division of Science Services, also participated in several of these.

Judgings.—The Grading Officers judged in the Dairy Produce Section of the Sydney Royal Show and Newcastle Show, the North Coast National and other country shows, and in various

competitions associated with the Annual Conference of the N.S.W. Division of the Australian Institute of Dairy Factory Managers and Secretaries.

Butter Wraps.—Experimental work continued in connection with surface deterioration of print butter and the use of various types of wrapping materials. Reports were supplied to the Industry.

Stores Inspections.—Registered Dairy Produce Factories and Stores in the Sydney metropolitan area were inspected. Remedial orders were issued where needed.

Retail Butter; Quality Control Survey.—Surveys were done in the Sydney metropolitan area and country districts to determine quality of butter at retailer/consumer level. Samples were subject to sensory grading and biological and chemical analysis. There were discussions with distributors and manufacturers with a view to checking any irregularity detected.

Examinations for Competency Certificates.—Examinations under the Dairy Industry Act were conducted for Certificates of Competency in buttermaking (twenty-seven certificates issued) and cream grading (thirty-one certificates issued).

Milk Products Other Than Butter

Cheddar Cheese.—Quality has deteriorated over the year, due mainly to failure of factory management to maintain grading standards of milk received for manufacture. Lack of trained staff in factories contributed.

In recent months Dairy Division officers have increased their activities in the implementation of Pure Food Act Regulations relating to sediment in the raw milk supply. This, and generally increased supervision of grading and manufacturing techniques, should improve cheddar cheese quality over the next year.

Cheese Varieties Other Than Cheddar.—Ricotta, Romano, Mozzarella, Provolone, Cheedam, Fetta, Gouda, Edam, Pecarino, Blue Vein, as well as numerous combinations of cottage types are manufactured. Five factories are now manufacturing them. One large Victorian manufacturer opened a branch in Sydney this year to make some of the Italian varieties.

Production of varieties other than cheddar has not, however, expanded greatly. Independent, metropolitan cheesemakers find supplies of manufacturing milk hard to get at a reasonable price.

Consumer interest in Australian cheese is beginning to increase, as with Australian wine some ten years ago; the Australian public starting to realize that locally made cheeses equal and often are superior in quality to the imports.

National cheese sales increased by 25.8 per cent during the promotional period of a "Cheese Carnival" last year. Some manufacturers and retailers increased sales by up to 60 per cent.

Five cheese tasting evenings in conjunction with the Australian Dairy Produce Board drew about 1,500 people.

Cottage Cheese and Cultured Milk Products.—These products are still expanding. With further promotion, consumption will continue to rise.

One big Sydney company will be in new premises soon, to further expand its cottage cheese production.

Another Sydney yoghurt manufacturer who started within the past 18 months is now duplicating the plant, aiming at double shifts and to treble output to meet anticipated demand.

The Australian public has accepted fruit yoghurt and the 5 per cent fruit pulp addition has also benefited the fruit industry. This year, twelve N.S.W. manufacturers produced some 1,200,000 gals of yoghurt, about 50 per cent more than a year previous.

Imported Cheese.—Copies of cheese "Permits to land" are received from the Animal Quarantine authority by the Dairy Division, but due to insufficient staff much of the imported cheese has not been inspected by this Division. In the consignments seen, the quality from the Scandinavian countries has generally been good, but Italian, Greek, and Bulgarian cheeses have often been badly packed and mould-deteriorated.

In the 12 months to 31st March, 1969, some 607 shipments amounting to 2,307 tons were landed at Port of Sydney, about 50 per cent of all cheese imports into Australia.

Processed Cheese.—Production is still expanding and yet another manufacturer will start to process cheese in Sydney in the coming year. The 1968-69 production is estimated to have been 10 per cent more than the 3,375,000 lb achieved in 1967-68.

Condensory and Other Products.—There was no major problem, other than lower production of these in 1968-69. Production was lowered by adverse seasons and quota combinations leading to less milk being surplus to Milk Board needs.

Ice Cream.—Ice cream production expanded slightly. There appears now to be stability within the industry following an interstate price war. About 2,000 gals of raw and pasteurized milk is sold in Sydney each week to manufacturers of Italian type ice cream.

Ice cream production in N.S.W. was 20,003,000 gals, about 4.72 gals per capita consumption. Consumption per capita throughout Australia is 3.14 gals.

Antibiotics in Relation to Cultured Milk Products.—Antibiotics are no longer a problem in this respect, since factories are regularly checking the milk supply, but farmers not using antibiotics for mastitis treatment try to forward mastitic milk.

Biological Survey Affecting Cheese Quality.—In this survey in conjunction with the Division of Science Services the latter examined ninety-six samples of cheese—from most factories in N.S.W. The results were valuable to dairy officers as a guide to the hygiene in factories within their Districts.

The percentages of satisfactory counts have been as follows, over the past 4 years:

Year	Percentages satisfactory for:		
	Coliform	Staphylococci	Both counts
1965-6	57.3	57.3	37.8
1966-7	77.7	51.5	36.9
1967-8	83.9	43.2	34.7
1968-9	77.1	67.7	55.2

An extension programme on factory staff hygiene has lowered the coliform count. Still more emphasis will be given to this programme because, in general, counts often are much too high.

Factories have been instructed to carry out coliform, laboratory pasteurized count and total counts at regular intervals. The results are recorded and checked by dairy officers. Farmers are notified of the results of tests and counts done on their milk supply.

Chemical Survey.—This survey is important to dairy officers in gauging factory treatment methods and the efficiency of factory equipment. The results enable dairy officers to discuss with factory management the particular problem. Factory management are keen on this service as an independent assessment of their products.

Under pasteurization, low fat cheese and cheese with high sediment content are some of the defects highlighted by the survey, and steps have been taken to rectify them.

DAIRY SCIENCE SCHOOLS

Twenty-one Dairy Science Schools were held, at various locations, to instruct and examine factory operatives (and Hawkesbury Agricultural College Dairy Technology students) for the Certificate of Qualification under the N.S.W. Dairy Industry Act. The twenty-one schools comprised fourteen on Milk Grading, five on Milk and Cream Testing and Cream Grading, and two on Milk and Cream Testing. In addition, candidates for Cheese Maker Certificates were examined at four cheese factories and candidates for Butter Maker Certificates at seven butter factories.

Examination	Candidates	Competency Certificates Issued
Milk Grading	132	92
Cream Grading	43	31
Milk Testing	75	48
Cream Testing	69	45
Cheese Making	21	21
Butter Making	31	29

OTHER SHORT SCHOOLS

Schools re Mastitis Control Programme.—Three schools were held to familiarize participating or co-operating officers with the essentials. The schools, each of 2 days duration, were at Grafton Agricultural Research Station, Tocal Agricultural College, and at Graham Park Artificial Stock Breeding Centre.



Practical Dairy Products Technology

Amendments to the Dairy Technology Diploma course at Hawkesbury College now include external practical examinations in subjects affecting the Certificate of Competency issued under the Dairy Industry Act. *Inter alia*, each student must have at least 12 months experience in a dairy products factory before satisfying the Certificate of Competency conditions

Fifteen officers from head office and Hawkesbury Agricultural College, thirty dairy officers, three livestock officers (dairy cattle), five dairy project officers, twenty-two Animal Industry Division field officers, three Science Services Division officers, two Regional Supervisors, four Wollongbar Agricultural Research Station officers and four Milk Board officers attended for one or other of the schools.

Milking Machine Efficiency School.—Supplementary to the Mastitis Control Programme Schools, the six Dairy Project Officers were brought together for this, to assure standardisation of techniques used in the Programme and review of progress.

Herd Recorders School.—The seventh school for herd recorders was held at Hawkesbury Agricultural College in May, 1969. This completed the second round of attendance at such a school by the Recorders since the schools were started in 1962.

Technology Refresher School for Dairy Officers.—This was at Taree, from 28th April to 2nd May, 1969. All twenty-one officers in the North Coast Region and Mid Coast and Hunter Region, and the Windsor District, attended. Also in attendance were five Specialist dairy officers (from head office), five dairy research officers (from Hawkesbury Agricultural College), two dairy bacteriologists (from Science Services), an officer from the editorial staff of the Department, the Milk Board's District Supervisor, and five other Supervisors. Guest speakers included an Assistant Principal Veterinary Officer, a Special Veterinary Research Officer, and the Special Agronomist (Fodder Conservation).

The theme was "Quality Control of Milk and Milk Products". Some thirty-four short addresses and the discussions covered: production and management on the farm; manufacture, biological and chemical control of dairy products, in particular butter and cheese; and Mastitis control.

EDUCATIONAL COMPETITION

The Three-Years Dairy Farm Improvement Competition

The District dairy officers were again District Judges for the 1966-67 "Country Life" Dairy Farm Improvement Competition. Besides judging farms in their District the officers also advised the competitors on whole farm operation and management. In the course of judging and advising each competitor, officers themselves gained a wealth of knowledge from the forty farms judged.

The Nowra District dairy officer was State Judge, assisted by the Kiama District agronomist and a representative of the N.S.W. Milk Board which jointly sponsors the competition with "County Life" Newspaper.

This competition requires a farmer to participate for at least 3 years. The type of competition has much to commend it. Results achieved in the two previous years provide comparisons for the final year of judging, and measurement of progress.

COMMONWEALTH EXTENSION SERVICES GRANT (C.E.S.G.) DEMONSTRATIONS

Mastitis Control Programme.—Establishment of these demonstrations is mentioned elsewhere in this Division's Report. Near to 75 per cent of the projected forty demonstration farms have been initiated and the others will be started in 1969-70.

Solids-not-fat Recording.—These are dealt with in the "Herd Record Improvement Scheme" section of this Division's Report.

STATISTICS SUMMARIZING FIELD OFFICER ACTIVITIES

Activities of the field officers of Division of Dairying in their extension and regulatory duties have been summarized statistically as follows:

Farm visits	9,701
Factory visits	2,955
Demonstrations and trials	80
Field days conducted	45
Meetings and group discussions attended	817
Schools and Conferences attended	223
Mass Media:	
(a) Talks on radio and television (including talks at field days, etc.)	498
(b) Press articles	264
Tutorial classes conducted	119

A number of the Senior Dairy Officers function also as "Officer-in-Charge" at the respective District centre of the Department and one this year has acted also as a Regional Supervisor. Time diverted to these duties has naturally affected their field activity statistics.

Dairy officers handled numerous other duties besides those statistically summarized: office interviews, letters and telephone enquiries on matters relating to the Dairies Supervision Act, Dairy Industry Act and Pure Food Act, Factories and Shops Act, and general extension matters.

The Field Days.—The 45 field days conducted drew a total of 3,038 people and were concerned with dairy hygiene, shed management, milking machine efficiency, soil stabilization around dairy premises, and topics raised by the farmers for discussion. The latter included talks on farm management, pasture feeding and crop utilization.

Farm Discussion Groups.—Sixteen Farm Discussion Groups (including seven Milk Meter Groups) are operating. Some other groups have waned or become inactive. With expansion in number of livestock officers (dairy cattle) there will be more opportunity to set up Groups among Herd Recording farmers and consequent better use of the recorded data.

THE ACTS

Statistics of Dairy Industry Act Activities

Registered Stores and Factories.—The total of Registered Dairy Produce Stores for 1968–69 was 211; as against 193 in 1967–68; 154 in 1966–67 and 131 in 1965–66. A number of stores remain to be registered. Thirty-two stores were inspected during the year.

There are now 102 Registered Factories, there having been one cancellation this year. Nineteen remedial orders were issued. One factory was prosecuted, successfully, for trading from unregistered premises.

Margarine Manufacturing Licences.—Six licences to manufacture table margarine were issued, and seven to manufacture cooking margarine; and seven permits to export table margarine.

Condition of Dairy Produce Factories and Equipment.—Equipment and buildings have been satisfactorily maintained. Applications, with plans and specifications, for the building of or alterations to three new cheese factories were received and approved.

Bega Co-operative Dairy Company is nearing completion of the installation of a new "Cheddarmaster" partially-automated cheese plant in a new building. Hastings Co-op. Ltd, Wauchope, has completed extensive renovations for Woolworths Ltd who have commenced cheese manufacture. Perfect Cheese Co. has completed a large cheese factory at Marickville and is manufacturing continental cheese varieties. Sunbrite Cultured Milk Products, Brookvale, have extended their premises for manufacture of continental cheeses.

Dairies Supervision Act

Supervision of dairies by local Shire and Municipal authorities continued in many instances to be very unsatisfactory. Dairy officers continued to press these authorities to have all dairies registered under the Act. This action has reduced from 370 to 249 the known unregistered premises.

The general standard of dairy premises is fair only, and continued to deteriorate. Officers of the Division of Dairying have given technical advice as required, and, when requested by Councils, jointly inspected dairy premises.

Pure Food Act

Warning letters were issued to five dairymen for failure to maintain dairy premises and equipment in clean and sanitary condition. A copy of the respective letter was forwarded to the appropriate Local Authority under the Dairies Supervision Act. Two prosecutions were launched.

Close liaison was maintained with Board of Health Officers regarding poor quality imported cheese.

Herd Production Improvement Scheme

HERD RECORDING

Staff

More Staff.—With the greatest increase ever, in one year, the staff establishment for Herd Recording this year comprised 124 officers (102 Herd Recorders, twelve Relief Recorders and ten Herd Organizers) as against 112 in the preceding year.

Staff Competencies.—Eight more Recorders qualified for the Certificate of Competency in Milk Testing, making a total of sixty-nine for the last 3 years, and 168 since March, 1962 when the Certificate was first issued.

Checks on the efficiency of seventy-five Herd Recorders were conducted in the course of the year's work.

Official Recording (Registered Pure Breds Only)

Some of the statistics (for the 12 months ended 30th June, 1968) are as follow: 293 herds recorded, six more than in the preceding 12 months; 9,177 cows completed lactations of 6 months and over, 1,381 more than in the preceding 12 months; butterfat production average 346 lb (4.1 per cent), 9 lb more than in the previous 12 months and 25 lb more than 2 years ago; and milk production average 8,450 lb, or 191 lb more than in the previous 12 months.

Group Herd Recording (Grade and Pure Bred Dairy Cattle)

The recorded cows totalled 97,966, the most ever recorded under the Group Scheme, and an increase of 10,707 compared to the previous year.

Cows that completed lactations of 6 to 10 months totalled 80,863 and their production average was 6,036 lb milk, 4.23 per cent test and 255 lb butterfat; 3 lb fat more than in the previous year and the highest recorded production so far. Milk production was up by 79 lb on the previous year and the highest ever recorded.

Cows that completed short lactations of from 1 to 5 months totalled 13,744. They averaged 2,410 lb milk, 4.11 per cent test and 98 lb fat.

The "all in" average for 94,607 cows completing lactations of from one to ten months was 5,509 lb milk, 4.23 per cent test and 232 lb fat. Part lactation cows totalled 3,359.

Total Herds Recorded and Cows per Herd

1,529 herds (an increase of thirty) were recorded, in ninety-one recording units, and averaged sixty-four cows per herd—six cows per herd more than in the previous year.

District Averages

The top three Districts, by averages, were: Orange (938 cows)—8,386 lb milk, 3.69 per cent test, 309 lb fat; Maitland (9,408 cows)—7,359 lb milk, 3.97 per cent test, 292 lb fat; and Deniliquin (9,750 cows)—6,460 lb milk, 4.39 per cent test, 284 lb fat.

Highest Individual Recording Units

The top three individual units by butterfat average, were all in Maitland Dairying District: Unit No. 1, 1,089 cows and 340 lb fat; Unit No. 10, 1,081 cows and 328 lb fat; and Unit No. 2, 945 cows and 319 lb fat.

Production by Length of Lactation

Cows milked for 10 months had a production average of 311 lb fat, compared to 302 lb in the previous year. As the months of the lactation decrease so does production.

Production of Age Groups

The 4–9 year old age group had the most cows (49,180) and the highest butterfat average (269 lb). The 2 year old age group averaged 216 lb fat, three years old 237 lb fat, and the 10 years and over group averaged 261 lb fat.

Top Cow for Milk and Top Cow for Butterfat

Top cow for milk was No. 114 of the Avondale College; 19,770 lb milk. Top cow for butterfat was No. 34 in the herd of J. I. Houghton; 832 lb fat.

Butterfat Production Range

Twenty-three per cent of the herds are in the range up to 199 lb fat; 55 per cent in the range of 200 to 229 lb fat; 20 per cent in the range of 300 to 399 lb, and 2 per cent in the range of 400 to 499 lb.

Top Herds (15 cows and over) for Butterfat and for Milk

The top three herds of the year for butterfat were those of: P. A. Walker, Lismore District—seventy-six cows, averaging 8,857 lb milk, 5.4 per cent test and 477 lb fat; V. G. and R. E. Pomfret, Maitland District—thirty-two cows averaging 12,062 lb milk, 3.7 per cent test and 452 lb fat; and Powles and Guthrie, Deniliquin District—sixty-three cows averaging 8,667 lb milk, 5.1 per cent test and 438 lb fat.

The top three herds for milk were those of: V. G. and W. E. Pomfret, Maitland Dairying District—thirty-two cows averaging 12,062 lb milk, 3.7 per cent test, 452 lb fat; Engsta Pty Ltd, Nowra Dairying District—twenty-one cows averaging 11,231 lb milk, 3.7 per cent test, 416 lb fat; and H. E. and J. C. Webb, Nowra Dairying District—twenty cows averaging 11,099 lb milk, 3.6 per cent test, 405 lb fat.

Influence of Month of Calving and Length of Lactation

This tabulation showed the average pounds of milk and of fat for cows calving in each month of the year, for each of the thirteen dairying Districts. The trend, similar to that of previous years, showed on a State basis that most cows calved between June and October, that best production is from May to August calvings, and that the peak month is June with a production average of 248 lb fat.

Longest lactations were from calvings in March, April, May, June and July.

GOVERNMENT HERDS

Activities were at high levels, quite comparable with those of the last few years.

Production in Government Herds

Hawkesbury Agricultural College again achieved the highest butterfat average (482 lb butterfat from fifty-five cows) though 2 lb less than the previous year's record. Both Grafton Agricultural Research Station A.I.S. herd (381 lb butterfat) and the Yanco Guernsey herd (470 lb butterfat) were substantially above the previous year's figures. Wagga Agricultural College Jersey herd (398 lb butterfat) and Grafton A.R.S. Jersey herd (398 lb butterfat) were slightly lower than in the previous year.

Milk production average was greater in all of the Government herds except the Wagga Jersey herd.

In the Official Section of the Herd Production Improvement Scheme, Hawkesbury Agricultural College was fourth for milk production and fifth for butterfat production, among the herds of more than forty cows. The Wagga Agricultural College Jersey herd was second from top for milk, and fourth from top Jersey Herd for butterfat, among those milking from fifteen to thirty-nine cows. Yanco Agricultural College Guernsey herd was the State's top Guernsey herd, for both milk and butterfat, in all herd-size groups.

Yanco Agricultural College and Research Station Guernsey herd won the William Newcombe Memorial Cup for the third successive year; the cup donated by the Guernsey Society for the herd with the highest producing group of six Guernsey cows. Production average for the six cows this year was 670 lb butterfat; the highest in the history of the competition. The previous best was 643 lb butterfat, achieved by Yanco Experiment Farm in 1958-59.

The Department has now won the William Newcombe Memorial Cup nine times since inception of the award in 1950.

Following is the Table of Production for the Government herds for 1966-67 and 1967-68:

Herd		Av. milk (lb)	Av. B/fat (lb)	Cows
H.A.C.: Friesian	1966-67 1967-68	12,869 13,157	484 482	55 55
Yanco: Guernsey	1966-67 1967-68	8,280 9,195	426 470	27 34
Wagga: Jersey	1966-67 1967-68	8,829 7,874	436 398	40 38
Grafton: A.I.S.	1966-67 1967-68	8,356 8,874	344 381	48 42
Grafton: Polled Jersey	1966-67 1967-68	7,298 7,313	350 349	43 45

Competitive, Show Results

A team of Jersey, Friesian, and Guernsey cattle respectively from Wagga, Hawkesbury, and Yanco Agricultural Colleges were exhibited at Sydney Royal Show with satisfactory results.

The outstanding performance was that of the Hawkesbury Agricultural College Friesians. This team gained the ribbon for the Most Successful Exhibitor in the Friesian section for the ninth successive year. Also, three Friesians bred at Hawkesbury but sold to other studs gained ribbons and enabled the College to win for the second successive year the Most Successful Breeder trophy—presented by the Friesian Cattle Club.

The Department gained at the Sydney Royal Show ten firsts, eleven seconds, twelve thirds, and seven fourths.

Prize money totalled \$322. Six animals sold at the Royal Show auction sales brought \$2,180. Top price was \$800, for a heifer from Hawkesbury College.

Dairy cattle teams were exhibited also at Leeton, Wagga, Grafton, Hawkesbury, and Lismore Shows. Most successful at the country exhibits was the Hawkesbury Agricultural College Friesian team. Besides other excellent wins in the breed, this team gained the award of Supreme Champion Cow and Supreme Champion Pen of Three Cows.

Semen in Lieu of Stock Purchases

For the first time in many years no animal was purchased for the Departmental studs. This results from developments in artificial stock breeding enabling purchase of semen instead of livestock. Probably very few animals will be purchased in the future. The exception would be the occasional specially bred cow for the breeding programme.

This year delivery was taken of 380 ampoules of semen (imported from New Zealand) from the top proven polled Jersey bull "Ardachie Corley". So far only a few of the ampoules have been used, but conception rate has been exceptionally high and the semen is apparently of very high quality.

The Department also purchased twenty-five ampoules of semen from a Yanco-bred Guernsey bull "Yanco Vera's Champion 4th". This bull had gained a top survey under natural conditions in Victoria and had then been purchased by the Victorian Artificial Breeders Co-operative Society.

Breed Society Classifications

The Department's Guernsey, Jersey, and Friesian herds took part in the respective Breed Societies' Type Classification Programme. (As yet the A.I.S. Society does not have a classification programme though currently considering it.)

The herds gained satisfactory type ratings. The Wagga Agricultural College Jersey herd has several "V.H.C." cows, and the Yanco Guernsey and Hawkesbury Friesian herd respectively have a cow classified "Excellent". These are the highest possible ratings for each breed.

Departmental Bulls in Artificial Breeding Centres

Twelve Departmentally owned bulls of various breeds are at present stationed in this State's Artificial Breeding Centres.

No new bull was forwarded to a Centre this year but currently three are on offer; a Friesian bull on offer to the Tasmanian Artificial Breeding Board, and one A.I.S. and one Friesian bull on offer to the New South Wales Milk Board.

Service and Stock Sales from the Government Herds

Demand for service of age bulls from Departmental herds has been steady throughout the year, although demand on the Guernsey and Jersey herds has been a little less than in previous years.

Fifty-five bulls and twenty-two females have been sold from the Government herds for stud purposes. For males the A.I.S. herd at Grafton and the Friesian herd at Hawkesbury have been under greatest demand. The waiting list affecting the Hawkesbury College Friesians is now 2½ years long.

Total value of stud sales, excluding animals transferred to other Stations, was roundly \$10,782 to 31st May, 1969.

Besides sales for stud purposes, each herd has been required to accumulate a number of females for transfer to research projects. In particular, sixteen Guernseys are at present being transferred to Wollongbar Agricultural Research Station for inclusion in the research herd there, and Friesian and A.I.S. cows are being accumulated in the respective stud for transfer to Wollongbar for breed comparison work in the multiple suckling trial.

The Polled Jersey Project

The Polled Jersey Project is now at the stage where females may be culled for other than the polled factor. This year there was some culling on a production basis and some on a type basis.

Production levels were maintained at much the same levels as last year; butterfat production down by 1 lb to 349 lb, and milk production up by 15 lb to 7,313 lb.

Birth of some blind calves continued and is subject of research by staff of the Veterinary Research Station, Glenfield.

Arrival of New Zealand semen from the top proven Polled Jersey bull "Ardachie Corley" has been mentioned earlier. This semen is of very good quality and the conception rate over the first eight or nine animals very high. Some of it will be used in the Wagga Jersey herd as well as the Grafton Polled Jersey herd. The females resulting from the Wagga inseminations will be transferred to the Grafton project to widen the genetic base—since "Ardachie Corley" is a monozygous bull for the poll factor and all calves born at Wagga should be polled.

SIRE SURVEYS

Herd Recording data has been processed on the computer to provide two runs of the sire survey.

The first of these runs was the "Official 1967-68 Survey", which included data from all bulls who had daughters completing lactation in the 1967-68 recording year. The new information has been added to the surveys of bulls that had daughters recorded in this State since 1962, to give the updated survey of all bulls with daughters recorded in the State.

The second was the special interim run to provide the latest possible information for bulls standing in the State's artificial breeding centres before the start of the 1969 mating season.

Information from both these runs has been made available to all extension officers of the Division of Dairying and to all herd recorders. Also, the information on bulls standing in artificial breeding centres has been made available to the rural press. And any farmer requiring survey of individual bulls has also been given the information.

The amount of herd recording data supplied to and received from other State Departments of Agriculture has increased. This has enabled early surveys from several young bulls used in more than one State.

Inter-state movements of data are likely to be increasingly important, particularly in the proving of bulls of the minor dairy breeds.

CALF MARKING SCHEME

Calves marked (i.e., tattoo identified) for the year ending 30th June, 1968, totalled 14,722; including 3,145 calves from artificial insemination.

Since the start of the Scheme, 175,011 calves, including 21,773 artificial insemination calves, have been marked.

SOLIDS-NOT-FAT RECORDING (S.N.F.)

The Two Experimental Recording Units

The two experimental, 30 day recording units continued to operate satisfactorily; one in the Windsor and another in the Nowra Dairy District. These units are financed by C.E.S.G. funds.

Analysis of the data for the year was completed for 1,982 cows (A.I.S., Ayrshire, Friesian, Guernsey and Jersey), making a total of 12,079 lactations since the project was started in April, 1961. Results showed that the S.N.F. content did not vary much as compared to the butterfat per cent for different breeds.

A downward trend, though not significant statistically, has been observed for percentage of S.N.F. over the years. The trend has been associated with increase in milk production during the period (1962-1968). It suggests that to increase milk yield or change milk composition, there must be selection for genetically superior sires and dams.

Goats Milk; Solids-Not-Fat Observations

Production records of goats recorded under "the official registered dairy goat production recording scheme" in N.S.W. for the years 1964-65 and 1965-66 were used as data.

Analyses of the data showed that Anglo-Nubian goats produced milk with highest butterfat (4.6 per cent), S.N.F. (8.8 per cent), and total solids (13.4 per cent); whilst Toggenburg and Saanen goats produced milk with lowest butterfat (3.7 per cent), S.N.F. (8.3-8.4 per cent) and total solids (12.0-12.1 per cent). Saanen produced the highest amount of milk (6.2 lb per day) and Anglo-Nubian the lowest (5.6 lb per day).

The analyses of data revealed also for goats milk a pronounced seasonal variation in the butterfat, S.N.F. and total solids per cent. Both S.N.F. and butterfat decline to minima in later summer and early autumn. Highest S.N.F. and butterfat were in spring.

Influence of Age on Goats' Milk.—The analyses of data on goats' milk for the two years 1965 to 1967 provided a study of the influence of age on milk and butterfat. Marked increase in milk production up to about 3 years, and a slight decline from third to fourth year were apparent. After 4 years there was a rapid drop in production in mature goats (5 years and over). Maximum butterfat per cent was observed in the junior yearling group.

It would seem highly economical to keep goats ranging in age from senior yearlings to senior 4 years in the herd, for maximum production—milk as well as butterfat.

Dairy Research Group Activities (at Hawkesbury College)

GENERAL

The dairy research group received the last of the original equipment requested in the first full year in the new building.

Loss of Principal Research Officer.—The Principal Dairy Officer (Research) after only 11 months in the position accepted in August, 1968, another position (Chief Lecturer in Dairy Technology) at Hawkesbury Agricultural College. The Assistant Principal Dairy Officer (Research) has been Acting O.I.C. since then.

Projected Developments of the Research Building.—Anticipating continued expansion of activities, plans have been sketched for extensions to the research building to increase its capacity by about 60 per cent. Conversion of some of the unused space in the basement to house detergent and radioactive isotope work has started. Plans and estimates for a research milking unit in association with the Dairy Cattle Section have been prepared and the project has been given a Job Number.

Recognition for Industry Research and Development.—The Department has been recognized as an approved research body by the Australian Industrial Research and Development Grants Board. A grant from a detergent manufacturer for detergent research on this basis has been received.

Liaison with Standards Association of Australia.—Close liaison with the Standards Association of Australia continued, including membership in various committees and panels working towards standards for cleaning and sanitizing in the dairy industry and for milking machine performance and installation.

Milking Machine School and Conference, etc.—At the 4th Australian Machine Milking School and Conference, in Brisbane in August, 1968, papers were presented by two of the research officers. The six Dairy Project Officers also attended.

Research officers also have addressed field days, two on machine cleaning and two on bulk tank cleaning, and given lectures in various situations—including one to a detergent firm, one to a Herd Recorders' School and a series on Milking Machines, etc., to Dairy Technology students.

Influence on Mastitis Control Programme.—Drawing up and initiation of the Mastitis Control Programme (see earlier in this Report) closely involved the Acting Principal Dairy Officer (Research). He contributed to two refresher courses and conducted two schools for personnel engaged in the Programme.

DAIRY RESEARCH PROJECTS

Milk Powder Project

Manufacture trials were done regularly at the College Factory. Results of previous series of trials were confirmed, in that seasonal variation in milk composition was not marked and skim milk powder suitable for recombining into sweetened condensed or evaporated milk could be manufactured throughout the year.

Skim milk and powder were obtained from factories elsewhere in the State for comparisons with the local products.

By visits to other laboratories in Sydney and Melbourne, the method for estimation of heat stability of milk powder has been improved.

Infra-Red Milk Analyses (IRMA) Project

Work this year has shown that use of standard solutions (as developed by the Canadian Department of Agriculture) rather than optical filters is more successful in maintaining a calibration on IRMA. For two periods of 3 months the instrument was out of order, awaiting replacement parts. Precision and accuracy are now being checked.

Processed Cheese Project

Can Blowing.—Work on the use of nisin to prevent the blowing of cans was not continued. Greater emphasis has been placed on other things by the Australian Dairy Produce Board (A.D.P.B.). The nisin work will be taken up again when time permits, to complete it for the manual. A first draft of the manual, being added to as experience accumulates, may be issued in 1969–70.

Role of Calcium C-precipitate.—Main aspects of the role of calcium co-precipitate in processed cheese manufacture have been established. They are subject of a patent application on behalf of the A.D.P.B. and of a paper for publication. A study of the factors controlling pH in the final product has been completed and a paper is in preparation.

Measuring Physical Quality.—Development of instruments to measure the physical quality of cheese has progressed a lot. The correlations between different characteristics in processed cheese are being established. A further paper on the rheology of processed cheese will result from this work. Studies on the effect of the blend of natural cheese and of the emulsifying salt used in cheese processing have been commenced.

Australian Cheese and Japanese Processors.—Liaison with the A.D.P.B. concerning use of Australian cheese by Japanese processors has been continued.

Dairy Chemistry

Standard methods of analysis of dairy products, mainly butter and cheese, were established. They were used then in a survey of the chemical quality of butter and cheese. Butter samples (382) were analysed for moisture, salt and pH. Cheese samples (68) were analysed for fat, moisture, salt, pH and extraneous matter. Phosphatase activity was tested on some samples.

A colorimetric method to detect trace accounts of copper in butter was established and a small scale survey has been commenced.

The gas liquid chromatography equipment was installed and preliminary work done on familiarization and calibration.

Fermented Products Research

A continuous fermentation apparatus was installed in the Dairy Products Factory in February, 1969. Work to elucidate operating parameters was started. Immediate objective of the project is to produce Quarg, a soft cheese-like product, on a continuous basis.

The fermenter is a scaled-up version of one operating successfully at the University of New South Wales. Placed in the Dairy Products Factory it will be operating under commercial conditions and subject to the same conditions as other cheesemaking processes.

Detergents Research

Emphasis this year has been on the needs of the Standards Association Dairy Detergent and Sanitiser Committee (DS/1). The major work for this committee was development of a laboratory test to evaluate general purpose dairy detergents. Other work completed for this committee has been development of tests for foaming power, buffering capacity and insoluble matter content of dairy detergents.

A cleaning simulator has been designed and built to evaluate the effectiveness of dairy cleaning systems. A second simulator has been designed, to examine the deposition and removal of milk soil, using radio-active techniques. The A.D.P.B. has been asked to support some of this work.

Sanitizer Research

Work this year has been on evaluation of sanitizers, and in two sections; Skin Sanitizers, and Hard Surface Sanitizers:

Skin Sanitizers.—An experiment done in the Hawkesbury Agricultural College Dairy Factory compared sanitizing efficiency of a 3 per cent hexachlorophene sanitizer with that of a detergent containing no sanitizer; for hand washing by factory operatives. The sanitizer gave a significantly greater reduction in Staphylococcal counts on hands than did the detergent.

A field trial is now in progress, to evaluate the skin sanitizing efficiency of twelve products. Work will be done on the development of a laboratory *in vivo* test to evaluate skin sanitizer. The results from this test will be correlated with those from the field trial.

Hard Surface Sanitizers.—Chemical tests were done on iodophors, to establish methods to test iodophors routinely. An *in vitro* bacteriological test is being developed for evaluation of sanitizing efficiency of hard surface sanitizers.

Mastitis Research

A research officer to work on mastitis was appointed in February, 1969. A full programme of work has been planned. It involves studies on the influence of various factors in udder health and milk quality, including: vacuum stability, pulsation rate and ratio, inflation characteristics, and milking management. To what extent the planned work may be fulfilled will depend largely on whether necessary facilities, in the form of the proposed milking research unit, become available.

The research officer has already taken over the responsibility of testing vacuum regulators for compliance with the new S.A.A. standard, and has set up useful liaison with the Mastitis Control Programme—and with the local Dairy Project Officer in particular.

Milking Management Research Intended

Appointment of a research officer to specialize on all aspects of milking management, including shed and bails design, has not yet eventuated. This field of work remains largely untouched. Efforts to satisfy the need must be continued, to have a more balanced research team.

Dairy Husbandry Work

The husbandry aspects of the research group's work, which are the responsibility of the Assistant Principal Dairy Officer (Research), are now somewhat better catered for by the appointment of the mastitis officer. Other aspects covered are detergents and sanitizers.

Milking machine performance and milking management are covered only in so far as the activities of the Milking Machine Survey Officers permit. Consequently the proposed change in their title to Dairy Project Officer, and in their duties, is an important move which will greatly strengthen the team.

Implementation of the proposals is limited, however, by the extent to which the Assistant Principal Dairy Officer (Research) is able to devote time from other responsibilities. Full benefits from the proposals would be obtained if there were appointments to cover the other fields needing attention.

In addition to responsibilities, flowing from filling the role of Acting Principal Dairy Officer (Research), the Assistant Principal Dairy Officer (Research) maintained essential liaison with extension activities. He was closely involved in the Mastitis Control Programme, attending two courses and two schools. He addressed two field days on bulk tank cleaning and attended a regional conference in Lismore on large scale dairy units. He was required at regular meetings of the DS/1 Committee of the Standards Association of Australia, in Sydney and Melbourne. In respect of the latter, he was largely instrumental in drawing up the standard for vacuum regulators. This has now been issued by the S.A.A.

He lectured to Dairy Technology students on milking machines and on mastitis, and at a herd recorders' school, and presented two papers at the 4th Machine Milking School and Conference in Brisbane.

DIVISION OF SCIENCE SERVICES

Biology Branch

GENERAL

Overseas Study, Post-Graduate Training

Bacteriologist Mr R. J. Roughley on study leave at Rothamsted Experimental Station, England, as recipient of a Wool Board Senior Scholarship, has been awarded the Ph.D. degree of the University of London for rhizobiology research. Plant Pathologist Mr A. M. Smith completed a period of study leave at University of Sydney and was awarded the Ph.D. degree for his thesis "Oxygen and the Ecology of *Armillariella elegans*". Bacteriologist Mr A. C. Robinson completed his secondment to the Soil Microbiology Section, CSIRO Division of Plant Industry, Canberra, and has received the M.Sc. degree

of the Australian National University for research on host-selection of effective *Rhizobium* strains, competition between *Rhizobium* strains, and natural distribution of *Rhizobium* spp.

Five other officers of the Biology Branch are working on projects for the Master degree registered either with the University of Sydney or Macquarie University.

Plant Pathologist Mr R. W. McLeod whilst privately overseas visited nematode research centres in U.K. and on the Continent and made special studies of the cereal cyst nematode and the potato nematode, *Heterodera rostochiensis*. Bacteriologist Dr R. J. Richards visited dairy bacteriology research laboratories in U.K., Europe, India, and the U.S.A. during 1969.

Professional Visitors

Professor K. F. Baker, University of California, U.S.A., spent 4 months at the Biology Branch. Here he initiated research into aspects of antagonism between micro-organisms in soils. Dr K. C. McOnie, Manager of the Research and Technical Department of the South African Co-operative Citrus Exchange Ltd visited in the course of studying problems of citrus disease, marketing and culture. Other overseas visitors included Dr H. H. Flor, Research Scientist, University of North Dakota, U.S.A.; Professor Sachston of McGill University, Canada; Dr Nagpal, Professor of Horticulture, Poona, India; Professor F. Newhook, the University of Auckland, New Zealand; Dr P. S. Nutman of the Rothamsted Experimental Station, England; Mr V. R. Sundar Rao, Microbiologist, Indian Agricultural Research Institute, New Delhi; and Dr C. D. McKeen, Canadian Department of Agriculture. A number of interstate pathologists also visited the Branch.

Conferences and Schools

International Congress of Plant Pathology.—Three officers of the Biology Branch attended the First International Congress of Plant Pathology, in London, July, 1968; R. J. Roughley, R. D. Pares and R. W. McLeod.

Biology Branch School.—This school for Departmental officers, was on 30th April and 1st May, 1969. The purpose was to acquaint Division of Horticulture and Division of Plant Industry field officers with the types of work done by the Branch, and the methods used in plant pathology studies.

Mushroom Short Course.—The third "Mushroom Industry Short Course", organized by the Australian Mushroom Growers Association, was held in the Division of Science Services, Rydalmere. Dr W. A. Hayes, Senior Scientific Officer in the Mycology Department of the Glasshouse Crops Research Institute, Littlehampton, Sussex, conducted it.

Nurserymen's Association Seminar.—The Australian Nurserymen's Association held here a seminar on nursery production matters including disease control, soil mixes and treatments, salinity problems, and economics.

Banana Disease Conference.—A Banana Research Review Conference discussed here the research needs of the banana industry, and planned co-operative work to be done by Division of Horticulture and Division of Science Services.

Cereal Disease Research Conference.—A Cereal Disease Research Conference (held at the State Office Block) reviewed the position as regards major diseases of cereal crops in N.S.W., and discussed research needs.

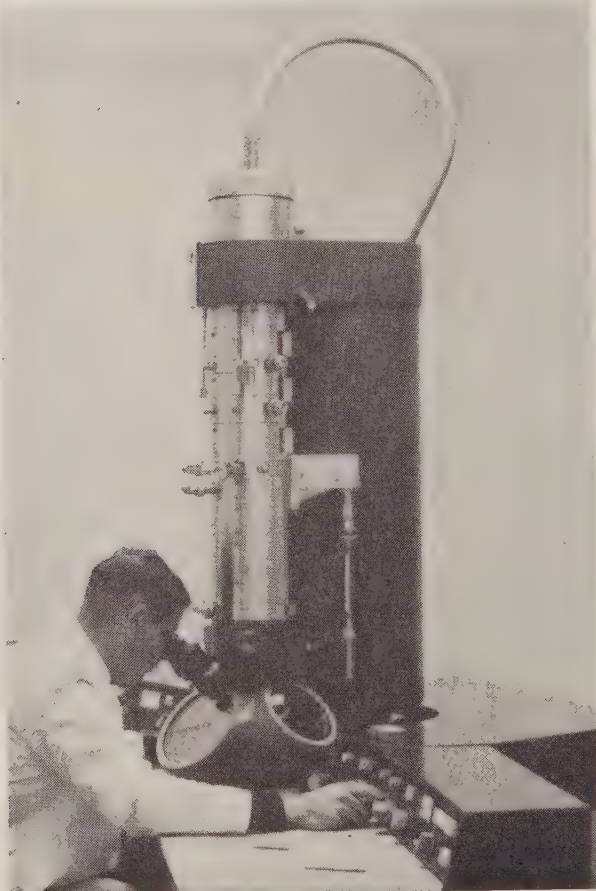
Hormone Damage in Vegetable Crops, from Use of Broiler Litter.—A conference on this problem and lines of work was held at Rydalmere; attended by officers of the Biology and Chemistry Branches and the Divisions of Plant Industry, Horticulture and Animal Industry. A committee was formed to organize suggested research.

Interstate Quarantine

Restrictions were continued on movement of lucerne hay into N.S.W. from areas in Victoria where there is bacterial wilt.

Restrictions were imposed on movement of stone fruit into N.S.W. from areas in Victoria where *Sclerotinia laxa* occurs.

A plant pathologist took part in a survey of grape growing areas in South Australia. Victorian, N.S.W. and South Australian officers participated to review the need to impose quarantine on movement of vine-parts from South Australia where dying-arm disease occurs.



Electron Microscopy at Rydalmere

One of the items in the recent considerable increase of modern equipment in the Division of Science at Rydalmere is an electron microscopy; *inter alia* an invaluable aid in the identification and study of viruses.

Biology Branch—Plant Pathology Section

CEREAL DISEASES

Wheat Diseases

Loose Smut (*Ustilago nuda*).—Effectiveness of a number of systemic fungicides against loose smut was tested. The infected grain was from hand-inoculated florets of a range of wheat varieties. None of the fungicides effectively controlled loose smut in the range of wheat varieties used. Incidence of loose smut in the untreated, control plants was very high.

Flag Smut (*Urocystis agropyri*).—Large areas of wheat were affected with this disease, especially in the north-west. Susceptible varieties are commonly grown there. Where resistant or semi-resistant varieties were grown, flag smut was not a serious problem.

Leaf Spot (*Septoria tritici*).—Several reports of heavy infections came from the southern tablelands. Cool, dull weather there during the winter and early spring favoured build-up of the fungus. Most of the infection was in the lower leaves. This disease possibly causes more loss than is generally estimated.

Barley Diseases

Scald (*Rhynchosporium secalis*).—This was quite common, especially in southern districts. In some cases the pre-maturity defoliation was quite severe, and yields were depressed.

Maize Diseases

Mosaic (Virus).—There were few reports of this on field maize. It does not at present appear to be very important. Glasshouse studies aimed at finding resistance were continued. It was found that an individual maize variety can vary in its reaction to the virus. Thus, breeding for resistance may not be as simple as was indicated in earlier tests.

Top Rot (Soft Rot Bacteria).—The condition results from soft rot bacteria entering mechanically damaged tissues in the upper stem. It was common on spray-irrigated stands during summer. Affected plants totalled 20 per cent in some crops.

Sorghum Diseases

Downy Mildew (*Phytophthora macrospora*).—It was particularly severe in some irrigation bays. In some low-lying, badly drained patches all plants were infected. A Griffith district survey revealed highest incidence in bays where germination had occurred in wet soils. Laboratory study of the relationship of soil moisture at germination to downy mildew infection has started.

Rice Diseases

Leaf Spot (*Helminthosporium sativum*).—Infection of seedling rice was widespread in the M.I.A. As in previous years when this disease has occurred, leaf spot incidence declined as the plants matured and grain yield was not affected.

Straight Head.—A condition resembling "straight head" as described overseas was in several crops. It involves failure of grains to develop. An excess of organic nitrogenous compounds, produced in the breakdown of lush pasture growth upon flooding, is thought to be the cause. The condition is most common in sod-seeded crops, and in some of these cases has substantially reduced the yield.

DISEASES OF FODDER AND PASTURE PLANTS

Lucerne Diseases

Witches Broom.—This was again the most common affection of lucerne. It was reported from almost all lucerne districts. Two factors, lucerne bud mite and a virus, seem able to induce very similar symptoms in lucerne. In most cases this year the lucerne bud mite was associated with the witches' broom and the leafhopper-transmitted virus not present.

Bacterial Wilt (*Corynebacterium insidiosum*).—Further suspected plants were examined for presence of the organism. In no case was the bacterium found. At present it would seem that this disease is not in New South Wales.

Clover Diseases

Subterranean Clover Re-establishment Problem.—Failure of subterranean clover pastures to re-establish during the autumn has been a major southern tablelands problem in recent years. Isolations from several collections of affected plants have almost invariably revealed a species of *Pythium*. This *Pythium* sp. has also been isolated directly from soil taken from affected paddocks.

In glasshouse tests the fungus caused pre-emergence damping-off of subterranean clover seedlings but could not attack plants after their emergence. The role of this fungus in the re-establishment problem is being further investigated.

Vetch Diseases

Post-emergence Damping Off.—*Pythium dissocotum*, as well as *P. debaryanum*, has been found to cause this disease. In field trials of the fungicide dexton in 1968 there was not enough rainfall to favour the disease. The field trials are continuing.

Bacterial Blight (*Pseudomonas stizolobii*).—Glasshouse tests demonstrated the susceptibility of nine legumes. Field infection of *Trifolium repens* and of *Mucuna* sp. have been recorded, and these plants are thought to be providing a reservoir from which the infection spreads to vetch under favourable conditions.

Rust (*Uromyces viciae-fabae*).—Field trials with several vetch cultivars have demonstrated that two collections (*Vicia sativa* CPI 26867 and CPI 23335) have resistance to the common rust strains. Field trials with these cultivars are continuing.

Grass Diseases

Kikuyu Yellows (Cause undetermined).—This disease was very widespread in the 1968–69 summer, in all river valleys of the north coast as far south as Macleay. Production of kikuyu was so reduced that milk yields, and returns to the farmers, were notably affected. The disease had greater effect this season because of the drier summer not favouring vigorous kikuyu growth in any case. The grasses *Paspalum dilatatum*, *Pennisetum typhoides*, *Zea mays* and *Sorghum vulgare* do not develop symptoms.

A Macleay district survey was done in May to assess the importance of the disease and to collect specimens for laboratory studies. These are proceeding at Rydalmere and Wollongbar, towards identifying the causal agent and developing control measures.

Also in investigating for cause, soil samples from the Lismore and Taree districts were examined for nematodes that could be acting as virus vectors. Nematodes in the samples included *Xiphinema ensiculiferum*, *X. monohysterum*, *X. americanum* and *Trichodorus lobatus*. None of these was constantly associated with the disease.

Cocksfoot Stem Rust (*Puccinia graminis*).—It caused severe losses in seed-producing areas at Cowra. In most paddocks no seed was harvested because of the heavy stem rust infection. The Cowra climate appears ideal for propagation of the fungus, particularly as spray irrigation is being used in seed production.

Trials have been designed to examine the possibility that a fungicidal spray programme may be economic on this crop.

Diseases of Oil Seed Crops

Safflower Root Rot (*Phytophthora* sp.).—A species of *Phytophthora* isolated last year from root-rot affected safflower at Glen Innes has now been identified as *Phytophthora drechsleri*—the common cause of safflower root rot in overseas crops.

DISEASES OF VEGETABLE CROPS

Potato Diseases

Potato Seed Certificate.—Records compiled by the Division of Plant Industry showed that except for a 4-acre crop of Saranac at Orange—which contained excessive virus leaf roll—no crop was rejected from certification because of excessive content of virus or other diseases for which certification tolerances are set down.

On the northern tablelands, purple-top wilt (caused by tomato big bud virus) was prevalent in the Glen Innes-Red Range area, but roguing in seed crops reduced its incidence to below the tolerance set down for certification. Purple-top wilt and blackleg (*Erwinia* sp.) were in crops in the Crookwell area of the central tablelands, but again not to the extent of causing rejection of crops from certification.

Common Scab (*Streptomyces scabies*).—Work in co-operation with the Division of Plant Industry to develop scab resistant varieties is continuing. However, in the 1968-69 season's trial at the Agricultural Research Station, Orange, there was not enough scab even on susceptible varieties to warrant examination of other varieties or seedlings for scab reaction.

Rugose Mosaic (Potato Virus X + Potato Virus Y).—Further tests were made to determine field reaction of Departmental seedlings to Potato Virus Y (PVY). The seedlings referred to in last year's report were again tested; S2881 (Awaba x U.S.D.A. seedling 336-123); S2894 (835a-4 x Awaba x Merrimack); and S2917 (Monak x 11-79 x Merrimack).

Tubers of these seedlings were interplanted with PVY infected tubers of the susceptible Walanga; the population of aphid vectors was allowed to build up on the seedlings and Walanga, and the vectors were transferred from Walanga to the seedlings. Sap inoculations were also done in the field, using sap from PVY-affected Walanga plants. Seedling S2894 reacted to field infection with a leaf drop streak symptom.

Bacterial Wilt (*Pseudomonas solanacearum*).—This disease was again present on the northern tablelands; recorded on the higher parts of the Dorrigo Plateau and in the Comboyne area. At Dorrigo infection occurred in about a third of the crops sown for table potatoes. Infection rates varied from 1 per cent to 25 per cent. The disease was reported fairly widespread in the Comboyne area. The Deputy Chief Biologist addressed a meeting of northern tablelands potato growers and carriers who transport potatoes. He dealt with the nature of this disease, its means of spread, and the measures to prevent the bacterium from contaminating clean soil, harvesting machinery, etc. Local field officers have since reported that growers in general are making an effort to contain the disease and by sanitation prevent its further spread on the northern tablelands.

Asparagus Decline and Replant Problem, Gundagai

Replanting of old asparagus ground at the Gundagai Asparagus Farm to the fusarium-tolerant selections of the Mary Washington variety U.C. 66 and U.C. 72 is proceeding. Seed of these selections is now readily available from the U.S.A., and seed also from a seed-production block of the tolerant line established at Gundagai in 1962. Present supplies will be enough to replant 130 acres in 1969-70.

The yield of marketable spears from the block of the fusarium-tolerant selection planted in old asparagus ground in 1963 was again compared with the yield of comparable plantings of the susceptible 500W strain. Both were harvested in the late spring and early summer of 1968. The yields were: 500W strain, 3,354 lb/acre; fusarium-tolerant selection, 3,887 lb/acre.

Progeny-testing continued with seed from the locally grown strain 500; from surviving plants in a replant area at Gundagai. This year over 800 seeds were harvested from plants which had been grown from seed of plants which had shown very little evidence of fusarium attack when grown in infested glasshouse soil. Seedlings from these seeds are at present under test at Rydalmere.

Tomato Diseases

Fusarium Wilt (*Fusarium oxysporum* f. *lycopersici*).—Cultures of *F. oxysporum* f. *lycopersici* were prepared and supplied to the tomato breeder at Yanco Agricultural College and Research Station.

Twenty-nine tomato varieties were tested at the Division of Science Services, Rydalmere, in 1968 for resistance to fusarium wilt. An interesting difference in the resistance mechanism was shown. In some resistant varieties (e.g., Campbell 17, Tropi Gro, VF 99, VF 100) the fungus is present in the tomato stem, while in others (e.g., Gamad, Half Long, Nematex, Umbrella, VF M10-10-16) it is not.

Diseases of Crucifers

Club Root (*Plasmodiophora brassicae*).—Co-operative work with the Bathurst District agronomist has been continued. This

is to find a fungicide superior to those at present recommended for control of this disease. Club Root is widespread on the Macquarie River flats.

Two methods were used to apply the test fungicides; the seedling root dip (1 oz fungicide/3 gal) and the transplant-site soil drench ($\frac{1}{4}$ pint fungicide/transplant site).

These 1968-69 results show that the fungicides dithane C90 and difolatan when used as a soil drench, give club root control superior to that of the previously recommended treatments (calomel-talc root dip and quintozone soil drench), and should allow good crops on soil heavily contaminated by the fungus.

Diseases of Beans and Peas

Bean Seed Certification Scheme.—Records compiled by the Division of Plant Industry indicated that 38 acres comprising nine crops were submitted for certification. Twenty-eight acres were passed as suitable, and ten acres were rejected—or withdrawn for reasons other than disease outbreaks.

"Summer Death" of Beans.—Conditions in the 1969 summer particularly favoured this disease. Losses were severe and widespread. The disease has now been recorded in all areas of the State except north coastal. The increasing use of susceptible stringless varieties for processing has accentuated the problem.

Transmission of "summer death" was achieved this season, for the first time; using the cicadellid (jassid leafhopper) *Orosius argentatus* (Evans)—a common and widespread native insect. The disease is thought to be caused by a virus or a mycoplasma-like organism.

Previously it had been established that many varieties bred for resistance to curly top, a cicadellid-transmitted virus disease in the U.S.A., were resistant to "summer death" in New South Wales. Fifteen advanced breeding lines resistant to curly top, introduced from the U.S.A., were found to be resistant to "summer death" under conditions of severe infection. Some of the fifteen were promising in processing tests. A further fourteen curly-top resistant breeding lines remained healthy in a late planting wherein the disease occurred—but with incidence in susceptible varieties too low for assessment of "summer death" reaction. Reaction of a wide range of dry-bean and stringed-bean varieties to the disease was determined. This testing has given most valuable results and is continuing.

Early published reports suggest that "summer death" is an indigenous disease and has become a major problem because of the increase in acreage of susceptible varieties.

Virus Diseases of Peas and Beans.—The top yellows disease of peas, caused by a virus either similar to or which is a strain of subterranean clover stunt virus, is troublesome in most seasons on the central tablelands and—in some seasons—in other areas. A replicated variety trial with twenty-four lines of peas was conducted with the Division of Plant Industry at the Agricultural Research Station, Orange, during the 1968 spring.

Severe natural infection occurred in susceptible varieties. Selections made by a New Zealand seedsman from Dark-skinned Perfection and Jade showed good tolerance. Other varieties and breeding lines from New Zealand showed varying degrees of tolerance.

Four new curly top resistant bean introductions remained free of this virus in a trial at the Agricultural Research Station, Orange, whilst known susceptible varieties showed a low percentage of infection. Incidence of the disease was not high enough for the introductions' reactions to be determined definitely. But the indication was that these lines may have tolerance. This disease affects the preferred stringless varieties particularly severely.

Diseases of Navy Beans.—Fusoid blight (*Xanthomonas phaseoli* var. *fuscans*) was detected in some navy bean crops, variety Seaway, in the Dubbo-Narromine area.

Unusually wet conditions there during the 1969 summer also favoured Sclerotinia rot (*Sclerotinia sclerotiorum*) and rust (*Uromyces appendiculatus*) and these were troublesome in some crops.

Cucurbit Diseases

Powdery Mildew (*Oidium* sp.).—It was more troublesome and widespread in inland irrigation areas than usual, because of wetter seasonal conditions. The two new rockmelon varieties bred by the Division of Plant Industry, with resistance to powdery mildew and to fusarium wilt (*Fusarium oxysporum* f. *melonis*), should be in commercial production next season.

MUSHROOM DISEASES

Virus Diseases.—Surveys in the late summer and autumn revealed virus symptoms in a number of crops. Electron micrographs demonstrated the presence of virus particles, similar in size to those found overseas, in badly affected mushrooms from two growers' properties. A third smaller particle (19 μ) was abundant in many collections and was associated with poor production. This particle was found to be present in a line of commercially produced spawn.

CITRUS DISEASES

Phytophthora Root and Collar Rot

Reciprocal Grafting's Effect on Resistance.—The modifying effect on the susceptibility or resistance to *Phytophthora citrophthora*, induced by grafting rough lemon or *Poncirus trifoliata* bark pieces into a resistant or susceptible stock has been studied.

In three experiments the grafting of rough lemon bark into a *P. trifoliata* stock or vice versa did not alter the resistance of the two citrus genera to *Phytophthora citrophthora*. In a further experiment, susceptibility was induced in trifoliata bark-grafted into a rough lemon stock. All experiments were done under conditions of temperature and relative humidity considered ideal for infection.

The resistance of citrus bark to *P. citrophthora* is possibly influenced by the content of readily available carbohydrates or by the ratio of total carbohydrate/residual dry weight.

Pore Size Effect on Downward Movement of the Zoospores.—Using uniform aluminium oxide grits as artificial soils, the effect of pore size (in the range of 2.7–100 μ radius of pore neck) on the downward movement of motile zoospores of *P. citrophthora* through tubes 1 ft in length and internal diameter 8 mm., was studied.

Motile zoospores were collected after passage through grits of pore neck radii of 100 and 41 μ but not through grits of pore neck radii of 24, 9.5, 4.5 and 2.7 μ . Zoospores of *P. citrophthora* are 10–16 μ in diameter with two lateral flagella 30–40 μ in length. Thus a pore neck radius of 24 μ or less was not enough for passage of motile zoospores.

Growth of *P. citrophthora* and Other Root Rotting Fungi Through Steam Treated Soil.—Thirty-three moist agricultural soils were steam treated (60° C/30 min.) to kill pathogenic fungi, and 3–4 inch columns of soil were placed on plant growth tubes above 1 ml dilute lucerne agar whereon the fungus was growing. The fungi used in this study were *Phytophthora citrophthora*, *P. cinnamomi*, *Pythium ultimum*, *P. debaryanum*, *Verticillium dahliae*, *Rhizoctonia solani*, *Fusarium oxysporum* and *Sclerotium rolfsii*.

Growth of the fungi through the tubes was assessed after one and two months by baiting the fungi from the tops of the soil tubes, using lucerne stems sterilized with propylene oxide. All fungi with the exception of *Verticillium dahliae* were capable of growth through the soil columns. Certain soils suppressed growth of one or more fungi; possibly due to antagonistic fungi, bacteria and actinomycetes.

Studies of Chemical Control of *Phytophthora Root Rot*.—Glasshouse studies of effect of dexton on the growth of citrus seedlings in steam-sterilized soil infested with *P. citrophthora* showed that even using monthly drenches of a 1,000 ppm solution of dexton, severe root rot of rough lemon and sweet orange seedlings still occurred. It is suggested that pockets of the fungus escaped the fungistatic action of dexton. Drenching with decon resulted in increased growth of all seedlings including the *Phytophthora*-resistant stock.

Virus Diseases of Citrus

Greening Virus.—Indexing of citrus trees for greening virus is continuing in the glasshouse at Rydalmere and in the field at Narara Horticultural Research Station. No definite conclusions can yet be drawn regarding possible presence of this disease in New South Wales.

Psorosis B.—In studies of virus-strain interference, two isolates of mechanically transmitted strains of crinkly leaf-infectious variegation, two isolates of psorosis A with bark and leaf symptoms, and two isolates of concave gum psorosis, were inoculated separately into Muscio mandarin and Ruby Blood sweet orange seedlings. After leaf symptoms developed, these seedlings and ten uninoculated controls were inoculated with buds or leaf pieces infected with psorosis B.

Of 100 seedlings inoculated, thirty-two developed the psorosis B ringspot and variegation patterns after seventeen months. Symptoms developed more rapidly in sweet orange than in mandarin seedlings. Crinkly leaf, psorosis A or concave gum psorosis did not confer protection against psorosis B.

There are two possibilities: (1) that there are two virus entities involved in the psorosis A disease complex, namely a bark-scaling component and a component producing flecking or oak-leaf patterns on immature leaves. A third component, which could produce variegation and ringspots on mature leaves and depressed rings or grooves in the fruit, sometimes occurs; or (ii) psorosis B is unrelated to the psorosis syndrome, though usually if not always associated with it. It may be related to or identical with the citrus ringspot virus described by Wallace and Drake.

Indexing of Departmental Mother Trees.—(a) Psorosis: no trees indexed last year; (b) Xyloporosis: indexing of mother trees for xyloporosis is continuing, in collaboration with officers of the Division of Horticulture.

Grapefruit Stem Pitting.—Observations, in collaboration with officers of the Division of Horticulture, continued on the protection given by mild strains of stem pitting against natural infection with severe strains under field conditions. Protection appears to have broken down in a few mild-strain trees at Somersby. These have developed a staggy appearance and their fruit are lopsided and small.

One aphid-purified severe strain of stem-pit virus, inoculated into mild-strain propagations in the planting at Narara, has produced lopsided fruit within 1 year of inoculation.

Citrus Black Spot (Guignardia citricarpa)

Work on Spray Programmes.—The programme of experimental spray applications was continued in a 30-year-old block of Valencia orange trees at Mangrove Mountain. Seven fungicides found promising in the previous season were compared with a non-sprayed treatment. The season provided moderately severe disease incidence, but the crop was very light.

Two spray programmes (applications at petal-fall and nine weeks later) were compared with the standard three-spray Bordeaux mixture 3½–3½–100-zineb programme (applications at six-week intervals). All satisfactorily controlled melanose, but black spot incidence was high in some of the two-spray treated plots. A three-spray programme of Bordeaux mixture 3½–3½–100 plus alkyl resin wetting agent, applied at petal-fall and six weeks later, with a final spray application of zineb 2½ lb/100 gal. 12 weeks after petal-fall, gave the highest percentage of clean fruit; 83 per cent.

Of the two-spray programmes: Bordeaux mixture 3½–3½–100 (twice) gave 78 per cent clean fruit; Bordeaux mixture 5–5–100 dithane M45 gave 76 per cent; Bordeaux mixture 5–5–100/zineb gave 70 per cent; Bordeaux mixture 5–5–100/antracol gave 59 per cent; cuprox 1½ lb/gal (twice) gave 65 per cent; Bordeaux mixture 5–5–100/cufram gave 57 per cent. The unsprayed plots averaged 22 per cent clean fruit.

Although two-spray programmes in years of moderately light black spot incidence have satisfactorily controlled the disease, black spot development this season was severe and only the three-spray programme of Bordeaux mixture/zineb gave economic control.

In a supplementary spray trial, on young Valencia orange trees, the percentage of clean fruit from the respective three-spray programme was: thiabendazole, 75 per cent clean; benomyl, 91 per cent; nordox cuprous oxide, 97 per cent; unsprayed, 64 per cent.

Several new fungicide materials were compared with a weak Bordeaux mixture (3½–3½–100) three-spray schedule, on old Valencia orange trees at the Horticultural Research Station, Narara. The percentage of clean fruit from the respective three-spray programme was: benomyl, 90 per cent clean; Merck 17–3296, 85 per cent; Bordeaux mixture 3½–3½–100, 83 per cent; nordox cuprous oxide, 82 per cent; thiabendazole, 77 per cent; polyoxin, 69 per cent; cufram, 41 per cent; unsprayed, 40 per cent.

Citrus Nutrition Research

At the Horticultural Research Station, Narara, a nutrition trial has been continued in collaboration with the Chemistry Branch and the Division of Horticulture. Effects of different levels of nitrogen, potassium, calcium and magnesium on leaf composition, fruit quality and yield of Valencia oranges are being examined.

POME FRUIT DISEASES

Apples and Pears

Apple Scab (*Venturia inaequalis*).—Generally, primary apple scab infection was not of major importance this season. Three infection periods were recorded at Orange. However, development of secondary scab infection and in storage was the most serious for several years.

Ten infection periods were recorded in the Batlow district from 7th September to 18th December.

Scab Spray-Warning Services were again provided at Orange and Batlow in association with the Division of Horticulture. A spore trap was located in the Batlow area in order to assess inoculum loads.

Bitter Rot (*Glomerella cingulata*).—This disease of apples causes heavy losses in apple areas near Sydney in years of high rainfall and humidity. Differences between varieties in their susceptibility are now being studied, with a view to ascertaining the causes.

Zinc Deficiency.—A trial to compare treatments for the correction of severe zinc deficiency of apples was laid down in co-operation with the Chemistry Branch and the Division of Horticulture at Neurea near Wellington. A range of spray materials and times of application were examined. Leaf samples were analyzed by the Chemistry Branch. The trial will continue for at least another year.

Internal Bark Necrosis.—Symptoms of this disease are pimpling of the surface and necrotic areas in the bark of year-old growth, with associated scaling in older growth. Several apple varieties show the condition but Delicious appears to be most commonly affected. Reduced tree vigour and fruit production are associated. The possible role of soil conditions and budwood sources are being examined.

Virus Diseases.—In the absence (overseas) of the officer concerned, the programme of virus research was reduced considerably, but experiments previously set up were continued at Narara Horticultural Research Station.

Results have been obtained on experiments to determine the effect of temperature on symptom expression of apple mosaic virus, the effect of this virus on the growth of nursery trees, and the effect of an undescribed pear virus on the growth of nursery trees. Results have not yet been processed.

DISEASES OF STONE FRUIT

*Brown Rot (*Monilinia fructicola*)*

Epidemic in the Murrumbidgee Irrigation Areas.—M.I.A. losses from brown rot in peaches and apricots were heavier in the 1968–69 season than in any previous epidemic. Total loss in income to farmers amounted to about \$1,200,000 (42 per cent of the crop). Prolonged rain at the end of December, 1968, and at intervals throughout February and March 1969 favoured build-up of the disease. Despite the adverse conditions orchardists who followed the Departmental recommendations for brown rot control had high yields, and only small losses from the disease.

Epidemiology.—An important discovery was made regarding the infection process in ripening fruit. It was found that infections at this time exhibit latency, i.e., the period of time between infection and the appearance of rotting is variable and can be quite long. This provides an explanation of the frequent failure of fungicidal control in wet seasons: sprays applied (after an infection period) to apparently sound fruit cannot reach and kill the latent infections.

Studies continued on the dispersal of brown rot spores in relation to environmental factors.

Evaluation of Fungicides.—Excellent results were had with benomyl (1-butylcarbamoyl-2-benzimidazole carbamic acid) which showed promise in last year's trial. This chemical has penetrant action and can eradicate latent infections in fruit. Thus, levels of control that were not previously possible can be achieved. It can be used successfully before or after an infection period.

Control of blossom infection when benomyl was applied as a protectant was better than from the best commercially available fungicide. Remarkable control of blossom blight was had when benomyl was applied 2 days after an infection period. Commercially available fungicides have no controlling effect at all when applied after infection.

Several other chemicals with penetrant properties in fruit were tested (including thiabendazole). All gave some control of latent infections.

Apricot Brown Rot (*Monilinia fructicola*).—Growers in the Grose Vale area near Sydney have been unable to control this disease with the recommended spray programmes. A spray trial on early apricots at Grose Vale was therefore undertaken, but in the very dry season there was virtually no brown rot in the trial area and the results were inconclusive.

Root Rot of Peaches

Following a wet autumn many peach trees died out in the M.I.A. in the spring of 1968. *Phytophthora cinnamomi* was isolated in a number of instances. This fungus could pose a serious threat to the deciduous fruit industry in the M.I.A. Investigations are continuing.

Virus Diseases of Stone Fruit

Peach Rosette and Decline.—All peach plantings in the M.I.A. were surveyed in conjunction with the Division of Horticulture during October, 1968. The survey highlighted a general decline of yield in this part of the State, due to many factors—including infection by viruses.

About 50 per cent of all plantings showed symptoms suggestive of virus. Infection appeared more widespread in some peach varieties than in others.

After the survey, over 400 trees were sampled and inoculated on to peach seedlings and cucumber seedlings. This work resulted in the isolation of prunus ringspot virus on cucumber, and "greasy sunken mottle" (considered to be a reaction of apple chlorotic leaf spot virus) on peach seedlings. Some samples were also inoculated on to *Chenopodium quinoa* and these indicator plants developed symptoms resembling those due to apple chlorotic leaf spot virus. A number of peach trees selected as being apparently healthy yielded prunus ringspot virus.

Further elucidation of the virus complex and the contribution of the various components is awaiting completion of new virus research laboratories at Rydalmere.

Experiments to determine the effects of some viruses on the growth of nursery trees yielded results which have yet to be processed.

Apricot Decline (Suspected Virus).—A disease causing rapid decline of apricots in the East Kurrajong area near Sydney is being studied for cause and means of spread. Many trees have been affected in recent years and the disease is spreading. The condition results in rapid collapse and death of trees following delayed flowering and defoliation. Microscope examination has revealed gumming in water-conducting tissues near the bud union.

DISEASES OF GRAPEVINES

Downy Mildew (*Plasmopara viticola*).—It did not appear until early March, after harvest. Then several periods of heavy and prolonged rain in all grape-growing districts resulted in a rapid build-up of infection. Early defoliation occurred in vineyards which did not have adequate fungicidal protection.

A spray trial (started in the 1967–68 season) at Chipping Norton in County of Cumberland continued in the 1968–69 season. Absence of downy mildew during the growing season prevented assessment of the protective action of the twelve fungicides used. But later it was shown that Bordeaux mixture, dithionon and dithane C90 have very good persistence, protect foliage for several months after the last spray and hold the foliage on the vines. The results confirmed those of the previous season. Another fungicide, difolatan, on trial for the first time, was as persistent as the former three.

Little persistence was shown by dichlofluanid and vines so sprayed defoliated early. Also, basfungin and metiran showed little persistence. Copper oxychloride, copper oxychloride/zineb, maneb, mancozeb and zineb showed moderate persistence.

Effect of the fungicides on yield and quality was also studied but, as in the previous season, nothing significant was apparent.

Dead Arm.—Infections in the M.I.A. were light this season. Enough rain to cause infection occurred only once; a few days after budburst.

In a spray trial at Griffith, dinitro-ortho-cresol as a dormant spray at double the concentration used in 1967 gave very poor control. Phenyl mercuric chloride did not give better control than sodium arsenite. Reducing the concentration of sodium arsenite to one-quarter of the recommended strength did not result in a significant increase in infection, while spraying very early—early July—resulted in more infection than spraying in late August.

Virus Diseases.—Standard techniques for indexing grapevine fanleaf virus, grapevine leaf roll and grapevine vein clearing have been mastered.

Grapevine fanleaf virus has been found associated with the enation disease which mainly affects black muscat. The virus has not been isolated from healthy black muscat vines. Grapevine vein clearing has been detected in the *Phylloxera*-resistant rootstock varieties du Lot and 420A.

Survey for *Xiphinema index*.—Samples (at least 5 kg from each vineyard) were collected from vineyards at Balldale, Corowa and Barooga to determine whether *X. index*, the vector of fanleaf, occurs in the district. *X. monohysterum*, *X. americanum*, and *Meloidogyne* sp. and *Paralongidorus* sp. were found in samples, but not *X. index*.

DISEASES OF TROPICAL FRUIT

Banana Blackend and Squirter (*Nigrospora* Musae).—Experiments at Alstonville Tropical Fruit Research Station have shown that this disease can be controlled by incorporating 10 ppm benomyl in dipping solutions. This compares with 30–40 ppm of thiabendazole needed to give similar control under the conditions of the test.

Experiments in co-operation with the Division of Horticulture are testing the commercial application of thiabendazole. Preliminary recommendations for its use have been made.

Avocado Sunblotch (Virus).—This was detected at Alstonville Tropical Fruit Research Station. Appropriate quarantine measures were imposed.

Passionfruit Brown Spot (*Alternaria passiflorae*).—Differential spray treatments for brown spot control are now being tested at the Narara Horticultural Research Station (Somersby Section). It is yet too early for final assessments, but captan, thiabendazole, and ziram show little promise. On the other hand, from the limited data yet available, control through monthly spray application of copper oxychloride, difolatan, thiram, benlate, antracol, trimazone and dithane M45 seems satisfactory.

Fusarium Wilt of Passion Vines.—Progress has been made in the project to breed and select a plant of desirable type resistant to *Fusarium oxysporum* f. *passiflorae*, based on hybridization between *Passiflora edulis* and *P. edulis* f. *flavicarpa*. The work is at the stage where 360 self-pollinated vines have been planted out (December, 1968) at the Horticultural Research Station, Narara, and have made very satisfactory growth. They will be culled next spring, on accepted horticultural characteristics.

DISEASES OF ORNAMENTALS

Downy Mildew of Stock (*Peronospora parasitica*).—Again this was severe. It can be satisfactorily controlled in mature plants by fungicidal sprays but is difficult to hold in small seedlings. Of several experimental fungicides being tried, none has given satisfactory control.

Azalea Petal Blight (*Ovulinia azaleae*).—Testing of new fungicides continued but the disease was not very severe this year. Good control under these conditions, and without any phytotoxic effects, was given by daconil 2787.

Rose Powdery Mildew was quite severe again this year. Very good control was given by benomyl ($\frac{1}{2}$ lb of 50 per cent wettable powder in 100 gallons) applied every 14 days. *Black spot* and *anthracnose* were also reduced by this spray. Testing of this fungicide is continuing.

Rose Colour Break previously observed in the varieties "Montezuma", "Super Star", "Fragrant Cloud" and "Queen Elizabeth" was seen in the variety "Jolie Madame". Puckering of petals associated with the colour break was seen in the white-flowered variety "Iceberg". Though strongly suspected as being a virus disease, transmission has not yet been effected.

Phytophthora Root Rot of Ornamentals.—Testing of varieties of ornamental conifers for resistance to root rot caused by *Phytophthora cinnamomi* continued. Of eighteen varieties tested, ten were partially susceptible and eight resistant. Four isolates of the fungus were used in these tests and, where varieties were partially susceptible, differential susceptibility to isolates of the fungus were observed.

This fungus has also been isolated from the diseased roots of a number of Australian native plants.

Aerated-Steam Treatment of Seed.—Heat conduction within seed when treated with aerated steam has been studied. In experiments with bean seed so far, heat transfer has proved to

be relatively rapid and moisture content does not appear to have any effect. Also, temperature at the centre of the seed tends to remain higher than at the surface during treatment. This was also observed with seed that had been killed and also when hot-water was used as the heating medium. Removal of a portion of the seed coat prevented it happening. These investigations are continuing.

NEW PLANT DISEASE RECORDS

Over sixty plant diseases new to New South Wales were recorded.

On vegetable crops the main new record was by recognizing the disease of beans, "summer death". This is transmitted by the cicadellid *Orosius argentatus* Evans, a common and widespread species in Australia. The disease is thought to be caused by a virus or by a mycoplasma—or bedsonia-like organism.

On field and fodder crops the records included several new hosts; records of species of *Vicia* found infected with bacterial leaf blight, powdery mildew and rust in a trial of various lines of *Vicia* spp. on the north coast; root rot of safflower, caused by *Phytophthora drechsleri* Tucker, recorded from the northern tablelands; and several new records of grass diseases.

On ornamental and native plants there were several records of *Phytophthora cinnamomi* Rands, the plants growing in a suburban nursery; and several other new records of diseases of native plants (and of weeds).

CHECK LIST OF PLANT DISEASES IN NEW SOUTH WALES

Work on the Check List comprised mainly the checking of validity of many of the earlier New South Wales plant disease records. Many of the specimens whereon these records are based are kept in overseas Herbaria and several have been borrowed and examined. This work is clarifying the identity of many of the diseases recorded late in the last century from New South Wales. Subsequent workers have often accepted these records on face value without examining the basic specimens. This has led to some errors in published work on New South Wales diseases.

Systematic studies on several groups continued. Work on ergot and ergot-like fungi has been expanded; studies on rye grass smut continued; and a detailed examination is being made of several perithecial fungi able to attack cereals and grasses. This work will help clarify many problems in the cereals, grasses, field and fodder crops section of the Check List. Compilation of the Check List manuscript is proceeding.

THE BIOLOGY BRANCH HERBARIUM (DAR)

Over 1,500 specimens were added to the Herbarium, bringing the total to almost 23,000 specimens. As well as New South Wales plant parasitic fungi, specimens were received from other parts of Australia. A small collection of British plant parasitic fungi was also added.

Work has continued on preparing the Herbarium for computer indexing. At present, in co-operation with the Automatic Data Processing Section of the Department, a detailed design and feasibility study is being done. Initially, the essential information about each specimen will be stored in the computer and at later stages this record will be expanded to include more data. Considerable progress in coding specimen information has been made.

Specimens have been loaned to several institutions this year. Several enquiries on the identity of plant parasitic fungi have been received from other institutions. There have also been several local enquiries concerning the edible or poisonous qualities of local mushrooms and toadstools.

NEMATOLOGY

New Equipment.—New equipment obtained for nematology work includes a mist apparatus to extract nematodes from plant tissue, two Fenwick cans for extraction of cysts from *Heterodera* species from soil, Seinhorst elutriation apparatus incorporating the modifications published by Seinhorst in 1962 (Seinhorst, J. W. (1962) *Nematologica* 8, 117–128) and trays and plastic coated wire baskets for extracting small active vermiform nematodes from soil by the Baermann principle.

Nematode Collection.—Fifty-seven accessions were made. These included *Meloidogyne javanica* from a number of grasses not previously recorded as hosts in this State. Since *M. inornata* and *M. incognita* cannot be separated by their perineal patterns, eggs and larvae of two collections of *Meloidogyne* with typical inornata-incongita patterns were examined; the results showed that the nematodes were *M. incognita*.

Xiphinema ensiculiferum and *Paralongidorus* sp. were collected for the first time; *X. americanum* on four occasions. The nematodes placed in this group showed considerable variation both within and between populations. Variation was particularly evident in body width, spear length, and head and tail shape.

Cysts of *Heterodera* from roots of couch grass (*Cynodon dactylon* (L.) Pers.) were submitted by Mr B. Stynes of the Grass Research Bureau. This nematode appears to be a new species and Mr Stynes is making a detailed study of it.

Root Knot Nematodes, Nematicides.—A preliminary glasshouse trial and a field trial were done, to test the new nematicides temik and lannate and the animal anthelmintic thiabendazole against root knot of tomato.

The glasshouse trial included lannate and thiabendazole. At the concentrations used, both reduced root galling but both were phytotoxic.

In the field trial, galling—as shown by plants in the untreated plots—was severe in one replication and only slight in the other replications. In the heavily galled replication, the temik treated plants were almost free of galls, the plants in the other treatments were heavily galled. In the other replications, all treated plants were almost free of galling.

Resistance of Totamo Lines to Root Knot.—Twenty-three breeders' and introduced tomato lines were tested for resistance to *M. incognita* and *M. javanica*. *M. incognita* induced heavy galling and produced large numbers of eggs on all varieties except VFN 26, VFN 48A, Nematex, and CRB-23-74. No eggs were produced on these lines. Slight galling occurred on the roots of VFN 48A and these contained a few larvae. Only VFN 26, VFN 28A, and Nematex showed resistance to *M. javanica*. There was slight reproduction of this nematode on VFN 26 and Nematex but none of VFN 48A.

Grass and Cereal Hosts.—Root knot nematodes are best known as parasites of dicotyledonous plants, but grasses and cereals have been recorded as hosts of some species. Grasses and cereals were grown in infested soil to determine if populations of *M. javanica*, *M. incognita*, and *M. hapla* collected from New South Wales can attack them. *M. javanica* infested twelve of the sixteen grasses and cereals in the test.

The hosts included wheat, oats, barley, maize, *Phalaris tuberosa*, Wimmera ryegrass, crab grass (*Eleusine indica*) and summer grass (*Digitaria* sp.). Tests with *M. incognita* and *M. hapla* are still in progress.

Overwintering.—Pots of soil infested with *M. javanica*, *M. incognita*, and *M. hapla* have been sunk in the ground outdoors to study the seasonal activity of these species. Tomato seedlings transplanted to these pots at the beginning of March and April were heavily galled; seedlings set out in May were moderately galled. Soil and roots of seedlings transplanted in May contained large numbers of second-stage larvae at the start of June.

Cereal Cyst Nematode.—Cereal cyst nematode was found on a second farm in the Koraleigh district—where a first record for this pest was made last year. In this infestation, as in the previous one, symptoms were marked. However, the number of cysts in the soil is low, as determined by flotation in a Fenwick can; less than one cyst per 200 g of soil.

The fourteen wheat varieties, fifteen oat varieties, and nine barley varieties were sown in infested soil at Koraleigh by the Barham District agronomist. He reported that all varieties proved susceptible and that Prior barley seemed the only one to have some tolerance.

Biology Branch—Bacteriology Section

DAIRY BACTERIOLOGY

Seminars, Conferences, Lecture Courses, etc.

Officers of the Section variously attended the Dairy Factory Managers and Secretaries Annual Conference, the Fermentation Technology Symposium at University of New South Wales, meetings of the Standards Association of Australia—DS/3

("Bacteriological Standards"), and also, until the end of 1968, acted as microbiology lecturers to Food and Dairy Technology Diploma students at Hawkesbury Agricultural College.

Starter Cultures

The Section continued to supply starter cultures for cheese, yoghurt, and other cultured milk products to the New South Wales dairy industry. This year, 1,894 starter cultures were supplied; a total akin to last year.

Standards of propagating and handling cultures in factories are improving, but many factories still lack laboratory facilities at the necessary standard.

Butter Quality

Manufactured bulk butter consigned from country factories to the Central Grading Floors in Sydney, Granville, Blacktown, and Newcastle, were biologically analysed during the main producing months from September to April. In all 1,401 samples were analysed, for five different microbiological counts. Of the 1,401 butter samples analysed, 471 were from interstate factories.

The results, with comments on possible sources of contamination and recommendations for improvement, were sent to the District dairy officers and factory managers through the Division of Dairying.

Overall quality of the bulk butter has declined slightly since the last survey. This may have been partly due to the drought conditions.

Biological quality of retail print butter in country areas was surveyed. This involved seventy samples. Samples purchased in country centres by District dairy officers were sent to the butter graders of the Division of Dairying for organoleptic evaluation as well as to this Bacteriology Section for microbiological analysis. This type of survey is to assist butter processors, distributors, and retailers to maintain quality until the product reaches the consumer.

Several surveys of butter processing plants were done, and samples to be microbiologically analysed were taken from each stage of the processing. As far as possible, one sample was followed through each mechanical operation. The results of analyses on these samples indicate areas where improvements could be made in cleaning and sterilizing of equipment and in the hygiene of factory personnel.

Biological Quality of Cheese

Bacteriological analyses of cheese produced in New South Wales continued. Cheese samples taken once a month by the District dairy officers were analysed for coliform and staphylococcal contamination. Cheese quality overall has improved since the previous survey, but the coliform counts still leave much to be desired—the contamination levels will have to be reduced to meet export regulations.

Antibiotics in Dairy Produce

The programme involving examination of antibiotic excretion times continued. This was its second year. Additional antibiotics used for treatment of bovine mastitis have been tested in excretion trials, in conjunction with Glenfield Veterinary Research Station, to determine how long after infusion the antibiotic is in the milk of treated animals.

Antibiotics tested were penicillin, spiramycin, and a penicillin/streptomycin mixture. All conformed to the withdrawal time stated in the manufacturer's recommendations. Work will continue in the ensuing year, on other antibiotic preparations.

Mastitis Control Programme

This programme, jointly with the Divisions of Dairying, Animal Industry, Science Services, Marketing and Agricultural Economics, and the Biometry Branch, was started in January, 1969. The Bacteriology Section is responsible for the bacteriological analysis of milk samples from selected pilot herds and the subsequent testing of isolates to the antibiotics recommended for use in the programme. Some 2,000 samples have been analysed so far. Of these, about 1,400 showed growth of mastitis pathogens.

Samples have been received from seven herds at least once. Some herds have been sampled twice, and thus have entered the control period. Sampling for bacteriological analysis will continue, at 3-month intervals, until the end of a 2-year period for each herd.

Other Services

Biological defects in food and other products were investigated for commercial firms. Among the samples were yoghurt, goat's milk, Continental cheeses, cleansing lotion (cosmetic), and paint.

SOIL BACTERIOLOGY

Factors in the Efficiency of Root-Nodule Bacteria

Clover Root-Nodule Bacteria from Pastures in South-Eastern Australia.—A survey requiring systematic examination of the symbiotic status of subterranean clover pastures in different regions in southeastern Australia is continuing. Bacteria from the nodules of field-grown subterranean clover plants are compared for effectiveness; by inoculating test plants with them, then comparing the growth and nitrogen fixation of these plants with those inoculated with a standard reference strain.

As in previous years, all the root-nodule bacteria have shown remarkable variation in effectiveness—even between plants growing within inches of each other. However, whilst some areas are characterized by the poor quality of the isolates, other areas yield isolates whose quality can be described as satisfactory. This information permits sounder recommendations concerning subterranean clover seed inoculation.

An unexpected discovery was that the isolates, besides differing in effectiveness from area to area, also vary in effectiveness from year to year; i.e. isolates of varying effectiveness can be had from successive samplings of the same area. More work is needed to establish the cause of this variation, and will improve understanding of the ecology of naturally occurring root-nodule bacteria.

Inter-strain Competition for Nodulation.—It is well-known that the effectiveness of *Rhizobium trifolii* strains varies according to the host and environmental conditions as well as the differences between strains. Earlier work in this project showed that the more effective strains—in preference to those of lesser effectiveness—nodulate the host, and continue to do so even though the ineffective strains are in vastly superior numbers.

Experiments aimed at understanding this phenomena have continued. Experiments have shown that the host is responsible for the selection of the more effective strains and, indeed, that this selection occurs at or before the infection of the root by the bacteria. Furthermore, this selection can be related to the speed at which the bacteria are able to infect the root—and the plant's physiological response enabling this has been postulated. Further studies have suggested that this is host "recognition" of certain compatible strains, and may be related to cell wall composition of the bacteria.

Field studies have confirmed that the host is able to select the more effective bacteria, from a mixed population of bacteria whose effectiveness vary considerably.

In practical terms: the effective, competitive strains of root-nodule bacteria for use in legume inoculant cultures may be screened on the basis of their speed in forming nodules—rather than by costly and time consuming measurements of plant productivity. Moreover, ecological studies of the root-nodule bacteria using single "trap-hosts" will have to be revised. These studies are only relevant to the species of "trap host" used. Conclusions drawn from them cannot be extrapolated to other species or even to cultivars.

Sterilization of Peat for Rhizobia Culture

Sterilization of peat by gamma irradiation has not proved completely satisfactory under commercial conditions. A number of treatments have been used experimentally. This was an attempt to work out a practicable method to completely sterilize peat without developing conditions unsatisfactory for growth. It is not yet clear whether the failure of sterilization is due to specific resistance of some bacteria or is inherent in the treatment method. A satisfactory method of obtaining complete sterility has not yet been found.

During the investigation the presence of extremely heat resistant bacteria in peat was demonstrated.

Bacteria and Actinomycetes Antagonistic to Root Pathogens in Australian Soils

This work was started during the visit to the Biology Branch (December to March) of Professor Kenneth F. Baker, Professor of Plant Pathology, University of California, Berkeley, U.S.A.

Over forty soils from New South Wales, Queensland and South Australia have been examined for *Bacillus* and *Streptomyces* spp. antagonistic to *Phytophthora cinnamomi*, *P. parasitica* and *P. citrophthora*, *Pythium ultimum* and *P. debaryanum*, *Fusarium oxysporum* f. *lycopersici*, *Sclerotium rolfsii* and *Rhizoctonia solani*. A method of isolation was perfected.

Of 1,000 isolates of bacteria and actinomycetes from these soils tested for antagonism to these pathogens on agar, more than 200 have shown strong antibiosis and some have produced lysis. Many were active against three to six of the pathogens; some were quite specific.

Soils selected because of field inhibition of a pathogen have inhibited its mycelial growth in soil tubes, and yielded many antagonists effective against it. Soils lacking such field inhibition showed little inhibition and had few antagonists.

Isolates antagonistic on agar are being tested in soil. One isolate of *Bacillus* has proven to be antagonistic to *Rhizoctonia solani* in soil as well as on agar.

Testing Commercial Legume Inoculants

Two hundred and ninety packets of peat-inoculant purchased in country retail centres were tested. The 1968–69 survey covered inoculants for clover, lucerne, vetch, cowpea, *Desmodium*, *Lotus* and *Lotononis*. Results for cowpea were: 20 per cent graded "excellent" and 8 per cent failures; for *Desmodium*: all satisfactory; for *Lotononis*: 50 per cent satisfactory; for *Lotus*: 80 per cent satisfactory. Of the clover cultivars, 50 per cent failed to meet U-DALS standards; lucerne, 20 per cent failed; and vetch 77 per cent failed.

Entomology Branch

OBITUARY

By the sudden death of Mr P. C. (Carl) Hely, former Chief Entomologist (1963–67) in June, 1969, his many friends and fellow-entomologists, in Australia and overseas are at deep-felt loss. Carl Hely was admired as one of the outstanding figures in Australian entomology in recent decades. In retirement, he was commissioned by the Department of Agriculture to write a text book. When he died his manuscript for "Agricultural and Horticultural Insect Pests in New South Wales" was well advanced.

Mr F. A. Gibson's death in July, 1968, was also sudden, and a severe loss to the Department of Agriculture because of his important role for many years past in the registration of pest destroyers in N.S.W., and his valuable work on the systematics of Tetranychid mites.

SOME OF THE ACHIEVEMENTS OR PROGRESS

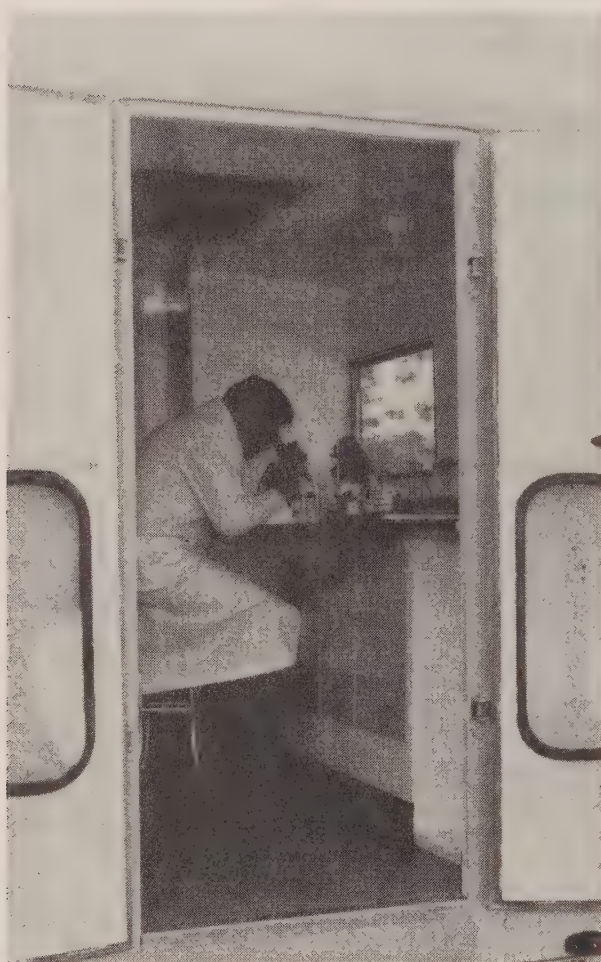
The year's activities yielded, *inter alia*:

- increased understanding of the build-up and behaviour of populations of the Australian plague locust *Chortoicetes terminifera*;
- diagnosis of maldison resistance in the rust-red flour beetle *Tribolium castaneum*;
- recognition of dieldrin resistance in the banana weevil borer *Cosmopolites sordidus*;
- firm indication of a successful conclusion to the Argentine Ant Eradication Campaign;
- demonstration of negative phototaxis in the amnemus weevil *Amnemus quadrituberculatus*;
- accumulation of laboratory information suggesting inability of the Australian sheep blowfly *Lucilia cuprina* to develop high-order resistance to organophosphorus chemicals.
- confirmation of prevention of damage by cotton pests by use of a "strategic schedule" of sprayings, rather than by schedule of more numerous spray applications at fixed intervals with consequently greater cost;
- better appreciation of the important pests of apples and their inter-relationship, as a result of the Co-operative Pest Management Programme in Pome Fruit Orchards.

SOME CURTAILED OR SUSPENDED ACTIVITIES

The year included also the suspension or curtailment of some fields of investigation, as follow:

- systematics and surveys of Tetranychid mites, and investigation of lucerne bud mite, because of the death of the entomologist concerned, Mr F. A. Gibson, in July, 1968;
- studies of earth mites, Noctuid caterpillars, Sitona weevil and clover case-bearer, following resignation of the particular entomologist, Mr L. R. Greenup, in June, 1968;
- annemus weevil investigations were curtailed, and studies of pests of tropical fruits and vegetables ceased, when the particular entomologist, Mr B. M. Braithwaite, transferred from the Entomology Branch to the Hawkesbury Agricultural College establishment;
- citrus pests investigations were necessarily curtailed due to the engagement of Mr J. G. Gellatley on administrative duties for a large part of the year.



Mobile Entomology Laboratory

Entomology Branch now has a mobile unit enabling laboratory methods to be applied to insect pest research in the field.

PASTURE AND FIELD CROP PESTS

Australian Plague Locust

The trend towards increasing locust *Chortoicetes terminifera* activity in central western districts in recent years culminated in a new outbreak. The first generation of locusts in the 1968 spring was characterised by small bands in the Coonamble and Coonabarabran districts. There were consequent loose, streaming flights in November and December. Dry weather at that time restricted an expected increase in locust population.

Good rain in January and February, 1969, led to a greatly increased second generation. From this, loose swarms developed in the region extending from Coonamble to Peak

Hill. Favourable locust conditions prevailed in March and April and a vastly increased third generation hatched. There were many extensive hopper bands throughout that region. They produced flying swarms which failed to migrate, but localized mass flights occurred—with some associated damage to early-sown wheat and considerable pasture damage.

Widespread and very heavy egg laying started in April and continued throughout May and into late June. The extensive egg beds threaten a major outbreak for the 1969 spring, if conditions favour the survival of young hoppers that will start to hatch in late September.

This outbreak follows successive years of low early-season rainfall. A multiple regression analysis done some years ago predicted that major increases in locust numbers tended to follow years in which rainfall was below average in the early part of the season.

Movement and behaviour of thirty to forty bands hatched from a large egg bed near Armatree in March have been traced in detail. Following location of the bands, their movements were plotted with the aid of a prismatic compass. Thus, distances covered, and changes in the size of bands, were known from hatching to fledging. The adult swarms were closely studied until oviposition, and all data were presented in map form.

An aerial survey of far-western districts in April by the Locust Patrol Officer located significant numbers of locusts in the vicinity of Ivanhoe and Tilpa; the former infestation represents a threat for next season. Increased locust activity was reported from Mudgee, Merriwa, Narrandera, Hay, and Corowa districts late in the season.

Experimental aerial treatment of adult locusts was conducted at Curban during February. Technical fenitrothion at 4.5 oz/acre was highly effective against a settled, high density, non-swarmling population. The insecticide was applied, undiluted, as an ultra-low volume treatment using a Cessna "Agwagon" aircraft fitted with a boom and T-jet nozzles.

Preliminary trials with a small "Turbair" misting device were carried out against hopper bands near Armatree in March, using approximately 10 oz technical fenitrothion per acre. There was spectacular mortality of massed 2nd instar hoppers.

Further locust series representative of the increasing population in central western districts were collected and are now being measured to determine phase status. Extreme types representing the full expression of gregaria or swarming phase have not yet been obtained, and full analysis awaits collection of such types.

Provision of a 4-wheel drive vehicle and caravan greatly increased the mobility of the Locust Patrol Officer. The unit was used in quantitative surveys in the central west, and enabled accurate knowledge of locust developments. Distribution and density of locusts are being mapped from the collected field-information.

Critical data on locust populations came also from the close co-operation and pooling of information with the CSIRO and Anti-Locust Research Centre Officers and regional Pastures Protection Board Field Officers throughout the season.

Experience in laboratory culturing of locusts was gained at Rydalmere, and there was some success in perpetuating colonies for life cycle and behaviour studies. Initially there was considerable difficulty in maintaining large stocks of locusts for bio-assay tests. Effects of various combinations of temperature and the number of hours of light, upon locust survival and reproductive capacity, were studied to overcome the problem. Exposing locusts to 24-hour illumination was effective in significantly speeding-up development, and thriving colonies were established in May and June.

Wingless Grasshopper

Extensive, dense populations of the wingless grasshopper *Phaulacridium vittatum* were reported from tableland and sub-coastal areas—from the Victorian border to the northern tablelands—in January and February, 1969.

An infestation in the Marulan, Tallong, Bungonia, Berrima and Big Hill districts was inspected in January. Other species, particularly *Austroicetes vulgaris*, *A. pusilla* and *Gastrimargus musicus*, were also numerous. This complex of species caused extensive and severe damage to pasture and field crops under the then prevailing dry conditions.

Spur-Throated Locust

Solitary adults of *Austracris guttulosa* were frequent throughout the central west during the summer but there was no report of damage.

Amnemos Weevils

Conditions had favoured egg laying and larval survival by *Amnemos* spp. from February to June, 1968, and led to a high adult population in the dry 1968-69 summer. Damage to sub-tropical legumes by adult weevils was considerable on the far north coast throughout the summer. The defoliation in many areas was enough to limit pasture growth in heavily-infested stands.

Biological Studies.—Biological studies were undertaken at Wollongbar Agricultural Research Station on *Amnemos superciliaris*, which infests pastures in the drier western sections of the far north coast. Egg production data, from the late summer and throughout autumn, established that highest oviposition rate occurred in April. Viability of eggs declined from 84 per cent in February to 14 per cent in May. The incubation period for eggs deposited February to May varied from 7-15 days to 12-15 days. A small proportion of eggs deposited between February and May needed 30 days to hatch.

Results of a series of head capsule measurements on larvae of *A. superciliaris* suggest that the larvae pass through up to nine instars.

Biological studies on *A. quadrituberculatus* were confined to ascertaining the effect of light on the vertical migration of adults in pasture. This was an attempt to develop a means of sampling for adult numbers. Negative phototaxis was established; adults moved upwards in the sward of pasture following exclusion of light for 30 minutes in January. The phototactic response declined as the season advanced.

Blue Oat Mite

Heavy populations of blue oat mite *Penthaleus major* continued. There were widespread reports of infestation of cereal and fodder crops in July and August, 1968, from the tablelands and central slopes. Favourable growing conditions masked the damage.

A screening trial, involving low volume sprays of imicidic emulsifiable concentrate (e.c.), azinphos ethyl e.c., methidathion e.c., omethoate e.c., and dimethoate e.c., all at 0.5 oz active ingredient (a.i.) per acre, dursban e.c. at 2 oz a.i. per acre, and methoxychlor e.c. at 3 oz a.i. per acre, was established at Lucknow in mid-July, on an old clover-ryegrass pasture. The most effective by far was dursban. It gave 99 per cent control at 30 days and 96 per cent control at 53 days.

Bryobia Mite

During warm dry spring and summer conditions in the Kangaroo Valley and south coast area, heavy populations of *Bryobia repensi* damaged pastures and ryegrass seed crops. The mite, not previously recorded as a pest in N.S.W., was identified as *B. repensi* by C. V. G. Morgan, Canada Department of Agriculture. The species has no common name.

In a spraying trial established at Terara in October, single applications of carbophenothion wettable powder (w.p.) and dicofol e.c., each at 1.25 oz., 2.5 oz., and 5 oz a.i. per acre, and omethoate e.c. at 0.5 oz a.i. per acre, were made with a low volume boom at the rate of 15 gallons of fluid per acre. The omethoate gave effective control for four weeks, and dicofol—at the 5 oz per acre rate—for three weeks.

Wireworms

Lindane dust, 4 oz a.i. per acre, and parathion granules, 8 oz a.i. per acre, mixed with fertilizer at sowing, were tested against an infestation of wireworms (*Crepidonemus* sp.) damaging wheat at Bribbaree in July. The wireworms had extensively damaged about 90 acres of young wheat sown in a paddock that had been under improved pasture for 10 years. This was an unreplicated trial. Parathion treatment reduced larval numbers by 60 per cent and gave 28 per cent increase in seedling establishment. Lindane treatment gave 40 per cent reduction of larvae and 51 per cent increase in seedling numbers.

Adults were bred in November from larvae collected in July.

Seed-Harvesting Ants

Surveys for seed-harvesting ants were done on the tablelands, north west slopes and central coast. No severe or extensive infestation was located, but seed-harvesting ants of the genus *Pheidole* were found in small numbers in most districts visited.

The widespread above-average rainfall in many districts during the 1969 season for aerial sowing of pasture seed led to good conditions for germination. Cold, wet weather reduced surface foraging by *Pheidole* ants. There was no report of "ant theft" of aerially sown seed.

Lucerne Seed Web Moth

Larvae of this native moth *Etiella behrii* infested pods of lucerne seed crops in the Lachlan Valley in early 1969, ate seeds and reduced the seed yield by up to 10 per cent.

In a screening trial at Eugowra in February, insecticides were applied as low volume sprays at flowering-and-podding stage to lucerne heavily infested with larvae in the pods. The insecticides and respective application rate per acre were: carbaryl w.p. 16 oz a.i., carbaryl w.p. 16 oz a.i. plus DDT e.c. 16 oz a.e., DDT e.c. 16 oz a.i., fenitrothion e.c. 6 oz a.i., maldison e.c. 8 oz a.i., mevinphos e.c. 5 oz a.i., monocrotophos e.c. 6 oz a.i. and parathion e.c. 2 oz a.i.

The mevinphos and the carbaryl plus DDT gave the highest mortalities of larvae, as assessed right after spraying and again 3 weeks later. The carbaryl alone gave some reduction of larval numbers; parathion was less effective; and DDT, alone, fenitrothion, maldison, and monocrotophos were quite ineffective.

Lucerne Bud Mite

Lucerne bud mite *Aceria medicaginis* is associated with abnormal lucerne plants; the plants dwarfed, with gross proliferation of terminal shoots. A spraying trial was applied to grazing lucerne at Temora Agricultural Research Station in April, 1968, to evaluate the mite as a pest of lucerne and to seek control measures. The results were not definitive, but at assessment in December there were fewer abnormal plants in plots sprayed with demeton-S-methyl, but no reduction in plots sprayed with thiometon or lime-sulphur.

Black Beetle

From the southern half of coastal areas, after the very dry winter-spring, there were very few reports of black beetle *Heteronychus arator*. Bega district was an exception. There the pest did some damage to pastures and maize.

In the northern half of the coastal area, dry conditions from September to December favoured the immature stages of the 1969 generation. Rainfall deficits were particularly marked at Kyogle and Grafton and these were the only districts affected to more than a minor degree. Serious damage in maize crops was reported in the summer at Kyogle and in spring and summer at Grafton. Pasture damage occurred at Grafton, and swarming flights were seen in February.

Cotton Insects

Investigations were continued in the Namoi Valley.

Thrips infestation of seedling cotton, usual in early spring, was of no consequence. Most crops were established late, due to cold and wet conditions in early October.

Common Bollworm, *Heliothis punctigera*.—It became active in mid-December and was at moderate levels by early January, but almost absent from most cotton crops by the end of January. Spraying with DDT at 1 lb a.i. per acre, at 7 to 10 day intervals during the peak of the infestation, protected bolls completely.

Spider Mite, *Tetranychus ludeni*.—This appeared in late January-early February. Control was effective with demeton-S-methyl, carbo-phenothion, methyl parathion or formothion. No field evidence of the organophosphorus resistance suspected at Myall Vale in the previous season was found.

Tobacco Looper, *Plusia argentifera*.—Was first observed in late January; caused leaf damage to a few crops in February. The loopers were attacked by natural enemies including a small polyembryonic encyrtid wasp *Litomastix* sp., a tachinid fly *Myothryia* sp., and a fungus *Entomophthora* sp.

Cotton Aphid, *Aphis gossypii*.—Did not infest crops until March. The populations increased markedly in early April, coinciding with cold weather which suppressed predators. The transverse ladybird *Coccinella repanda* controlled aphid infestations after early April when normal temperatures returned. There was practically no contamination of lint with "honey dew" excretions of aphids.

Rough Bollworm, *Earias huegeli*.—This first appeared in March. It was low in incidence. Insecticidal control was not needed this season. Most of the damage was to young bolls which set too late to reach maturity.

"Strategic Schedule" of Spraying.—A further trial at Narrabri Agricultural Research Station compared various spraying schedules. Last year's results were confirmed; viz., "a strategic schedule" of spraying, timed at pest population counts within the crop, provided full protection and preserved yield significantly more cheaply than a schedule of sprays applied at fixed intervals irrespective of pest populations.

Unsprayed plots yielded less, in the first pick on 21st April (by 600 lb/acre of seed cotton, or 0.4 bales of lint) than cotton protected against *Heliothis* damage. Last season's finding was confirmed; that protection of bolls set early in the growing season is important—as there is risk of frost damage to late-set replacement bolls.

Insecticide Screening Tests.—Further field screening tests with newer chemicals demonstrated the effectiveness of: endosulfan as an alternative control of *Heliothis*; methidathion, bidrin, and chlorphenamidin as additional effective miticides; monocrotophos, mevinphos, and bromophos plus carbaryl mixture as effective treatments for tobacco looper; and dicrotophos, omethoate, and cytolane as additional aphid killers.

Grain Sorghum Insects

Heavy and uniform corn aphid *Rhopalosiphum maidis* infestations were in irrigated grain sorghum crops in the Narrabri-Wee Waa-Burren area at early to mid-February. Big colonies of aphids formed on the "throats" of the plants just before extrusion of the seed heads, and they persisted despite the activity of aphid predators—especially the transverse ladybird *Coccinella repanda*. Growers who applied demeton-S-methyl at 2.5 oz a.i. per acre by air had almost 100 per cent control.

Safflower Insects

Rutherglen bug *Nysius vinitor* heavily infested an experimental safflower crop at Narrabri Agricultural Research Station throughout October, November, and December; with adults attacking the flowers and seed heads. Aerial treatment on three occasions with DDT at 1 lb a.i. per acre gave high bug mortality, but the crop was rapidly re-infested. The pest declined sharply in numbers in early January after several very hot days. The crop yielded well despite the persistent infestation.

Soybean Insects

Tobacco Looper, *Plusia argentifera*.—The looper infested experimental soybean plots at Narrabri Agricultural Research Station in February and March. Smooth leaf varieties sustained more leaf damage than hairy leaf varieties. Control was secured by spraying with mevinphos 4 oz plus chlorcam (toxaphene) 2 lb a.i. per acre, but repeat treatments were required.

Lucerne Seed Web Moth, *Etiella bebrii*.—The larvae attacked an experimental crop of an early maturing variety (Hills) at Narrabri Agricultural Research Station in January and February. Yield loss was estimated as 15 to 20 per cent.

On another Narrabri property the pest caused damage (less than 1.0 per cent) in a commercial crop of 200 acres left unsprayed.

Other Pests of Soybean.—The gelechiid leafminer *Stomopteryx simplexella* heavily infested that same commercial crop by mid-April. Other potential pests found in this crop, but at inconsiderable levels, were common blue butterfly *Zizeeria otis labradus* and three species of plant bugs—*Piezodorus hybneri*, *Dictyotus coenosus* and *Melanacanthus scutellaris*.

Rice Stem Borer

Observations were made in irrigation areas during the 1968 winter to determine incidence of the rice stem borer *Bathytricha truncata*. Sampling of outside rows, where the infestation is normally highest, indicated 1.7 per cent damage in the

Murray River areas and 4.8 per cent in the Murrumbidgee-Coleambally areas. These were comparable with the 1965 survey findings.

Bloodworms

An organophosphorus insecticide (abate) shown overseas to be effective against mosquito larvae, at very low application rates, was toxic to bloodworms *Chironomus tepperi* at 0.1 p.p.m. in laboratory studies at Yanco Agricultural College and Research Station. Application of 1 per cent abate granules at 10 lb per acre gave excellent control of bloodworms within 36 hours.

FRUIT TREE PESTS

Two-Spotted Mite

A population study of two-spotted mite *Tetranychus urticae* on peach trees at Yanco revealed that peak numbers were in mid-February, 243 active, various-stage mites and 186 eggs per leaf.

Control of this mite in densely foliated fruit trees is difficult. The automatic spraying methods do not satisfactorily penetrate and cover the tree's interior.

Soil application of systemic acaricides may offer a feasible alternative. This was tested on peaches at Yanco by twice incorporating into the soil under the canopy of each tree a granular formulation containing 10 per cent a.i. of temik, at a rate of 1 oz of granules for each inch of trunk diameter. The two applications, at 17 days interval, were made in mid-summer. The granules were taken into the soil by irrigation water right after application.

Though the trees were heavily mite-infested at the start of the trial, the temik kept the trees virtually free of mites for the 40-day period between the first application and the end of the trial. The untreated check trees remained heavily infested. There was no apparent phytotoxic effect from the temik treatment.

A spraying trial on Delicious apples at Orange sought better control by spraying at petal fall than by spraying later when the trees are fully foliated. Two treatments dates—30th October (petal fall); two miticides—chlorphenamidin e.c. 0.09 per cent and binapacryl w.p. 0.05 per cent; and two methods of application—hand guns and dilute automatic airblast, were utilized.

With each miticide and each application method, the treatment date did not affect level of control. The chlorphenamidin gave better results than binapacryl. Hand spraying gave much superior control to that with automatic spraying equipment.

The Co-operative Project: Pest Management in Pome Fruit Orchards

The Co-operators and Funds.—This was the third season of the Co-operative Pest Management Programme in Pome Fruit Orchards, wherein the CSIRO and four States (New South Wales, Victoria, South Australia, and Tasmania) have collaborated. The project, supported with funds from the Australian Apple and Pear Board and the Commonwealth Government through the Department of Primary Industry, has been administered by a Technical Sub-Committee appointed by the Standing Committee on Agriculture of the Australian Agricultural Council.

Locations and Treatments.—The N.S.W. study blocks are at Bathurst (Granny Smith and Jonathan apples) and Leeton (Granny Smith, with occasional Jonathan apples).

It was planned that pesticide applications be restricted to ryania for control of codling moth, captan for control of apple scab and dinocap for control of powdery mildew. However, due to gross development of San Jose scale infestation, winter oil was used on 147 of the 192 trees in the Leeton block in August, 1968.

The Bathurst Study Block.—Almost 15 per cent of fruits showed deep entries by codling moth *Cydia pomonella* despite a heavy schedule of ryania sprays—involving eleven applications at intervals of 1 to 3 weeks, at a dosage rate of 18 lb a.i. per acre.

Other pests that caused fruit damage, in descending order of severity of infestation, were: looper caterpillar *Chloroclystis* sp., San Jose scale *Quadraspidiotus perniciosus*, apple dimpling bug *Campylomma livida*, and light brown apple moth *Epiphyas postvittana*. These were far less damaging than was codling moth.

As in the previous two seasons, two-spotted mite *Tetranychus urticae* was adequately controlled by natural enemies. Most important predator was a mite provisionally identified as *Phytoseius macropilis*. Other important predators were a ladybird beetle *Stethorus vagans*, and a thrips *Scolothrips sexmaculatus*.

Woolly apple aphid *Erisoma lanigerum* was well controlled by its wasp parasite *Aphelinus mali*, supplemented to some extent by other predators including the green lacewing *Chrysopa* sp. and the ladybirds *Leis conformis* and *Coccinella repanda*. Although woolly apple aphid increased late in the season because of very favourable conditions, the infestation did not become commercially important.

Plague thrips *Thrips imuginis* severely damaged the blossoms for the second successive season. Granny Smith cropping was significantly reduced, although Jonathan cropping was not affected.

The Leeton Study Block.—As at Bathurst, codling moth caused a lot of fruit damage. Some 35 per cent of fruits showed deep entries despite a programme of fifteen ryania sprays at 15–18 lb a.i. per acre.

San Jose scale was the most serious problem. Substantial infestation had occurred late in the previous season, necessitating superior winter oil for most of the trees during the 1968 winter. All trees that did not get this oil spray became grossly infested during 1968–69, all fruits were severely infested, and many of these trees were almost dead by early winter. Natural enemies were present but quite unable to check the scale population sufficiently.

Plague thrips so severely damaged the Granny Smith blossom that cropping was quite impossible. Jonathan blossoms were less affected and a light crop was set.

Foliage damage by two-spotted mite was considerable but less severe than in the previous two seasons. Predators were in useful numbers but did not keep mite populations down to non-injurious levels. Predatory mites increased in numbers and activity during the season. A predatory thrips *Scolothrips* sp. was fairly numerous, but the ladybird beetle *Stethorus* sp. was less plentiful than in previous seasons.

There was no evidence that population of these natural enemies had been affected by the oil spray applied in winter, 1968. In addition to the predators, an unidentified pathogen is thought to have reduced mite numbers in late summer.

Caterpillars of light brown apple moth and of *Chloroclystis* sp. caused a slight amount of fruit damage.

Woolly apple aphid infestation remained at a very low level, probably due to several predators—notably lacewing larvae *Chrysopa* sp.

Injury by apple dimpling bug was negligible.

Summaries.—Successful control of certain apple pests by natural enemies has been demonstrated, and significant species among these natural enemies have been identified. At both Bathurst and Leeton woolly apple aphid was controlled in this way, and the comparatively low status of light-brown apple moth also seemed due to biological agencies. Two-spotted mite was very effectively suppressed by predators at Bathurst, but far less so at Leeton. Possibly the 3 years of the programme was too short a period for adequate regeneration of beneficial fauna under the Leeton conditions.

The information from the programme is a basis for further investigations of pest management in commercial orchards.

Queensland Fruit Fly

Incidence.—Queensland fruit fly *Strumeta tryoni* was abundant in coastal areas—especially in summer fruits in home gardens, and very active in summer and autumn in southern coast and tableland districts.

Home garden fruits were damaged in some northwestern and northern tableland towns in summer-autumn but, generally, there was little infestation in towns using fruit fly suppression schemes based on male-lure trapping and programmes of maldison plus protein hydrolysate bait sprays.

The fruit fly suppression scheme in and around the Murrumbidgee Irrigation Areas in the Shires of Carrathool, Coolamon, Hay, Leeton, Murrumbidgee, Narrandera and Wade, was continued. No adults were trapped nor were larval infestations of fruit detected in these Shires.

Infestations located in home gardens at Albury in March and June were controlled promptly by applying the recommended measures.

Banana "Commodity Treatments".—In further investigations at the Citrus Wastage Research Laboratory, Gosford, on banana susceptibility to skin injury by ethylene dibromide (EDB), a skin-blackening of winter-grown bananas occurred after chamber fumigation with 14 oz EDB per 1,000 cu ft for two hours at 70° F. Summer fruit was not injured by fumigation at dosages of EDB ranging from 10 oz to 15 oz per 1,000 cu ft for 2 hours at 70° F.

Effect of dimethoate dips upon fruit fly in artificially infested bananas was further investigated at the Wastage Research Laboratory. Ten test-groups of bananas, each containing not less than 10,000 fruit fly eggs, were dipped in dimethoate 0.05 per cent plus thiabendazole 0.1 per cent at 70° F for 30 seconds. There was no survivor. Estimated total mortality was 143,152.

In similar trials at 50° F, two test-groups of bananas were dipped in dimethoate 0.03 per cent plus thiabendazole 0.1 per cent. There was no survivor from 14,648 eggs in the first test, or from 13,696 in the second test. After dipping in dimethoate 0.05 per cent plus thiabendazole 0.1 per cent there was no survivor in two test-groups involving 14,096 eggs and 17,204 eggs.

Investigation of dimethoate dipping was extended to bananas infested with fruit fly larvae. Information is available from the first trial. There was no survivor in a test-group of fruit (estimated to contain 10,777 larvae) after dipping in dimethoate 0.03 per cent plus thiabendazole 0.1 per cent for 30 seconds at 70° F.

San Jose Scale

In a spray trial at Yanco on mature pear trees in late winter, carbaryl w.p. 0.1 per cent plus superior winter oil 1-100, and lime-sulphur 5-100 plus superior winter oil 1-100, each gave better control of San Jose scale *Quadraspidiotus perniciosus* than did methomyl (lannate) w.p. 0.06 per cent plus superior winter oil 1-100 or phosalone e.c. 0.06 per cent plus superior winter oil 1-100.

Two species of wasp parasites of San Jose scale were collected on peaches in the M.I.A. and have been submitted for identification. Their significance has yet to be determined.

Apple Root Weevil

In a long-term trial at Batlow, studying the effect of apple root weevil *Perperus languidus* on growth rate of Granny Smith apple trees, trees planted in 1963 are being grown under the following conditions:

- (i) In land from which old apple trees had been removed immediately before the replanting; weevil infestation excluded.
- (ii) In similar land to (i), but weevil infestation not excluded.
- (iii) In land which had been under pasture for 8 years after having previously grown apples; weevil infestation excluded.
- (iv) In similar land to (iii), but weevil infestation not excluded.

Measurements of trunk circumferences, and lengths of previous season's lateral growth, showed that tree growth had been retarded in the land where old apple trees had been grubbed and weevil infestation had not been excluded. Growth was not retarded on weevil-infested land where there had been no apple trees for 8 years before the replanting.

Apple Dimpling Bug

On Granny Smith apples at Bathurst Agricultural Research Station, studies showed that 50 per cent of the dimpling bug *Campylomma livida* feeding lesions had been inflicted by petal-fall stage, 80 per cent by 7 days after petal-fall, and 96 per cent by 13 days after petal fall. The conclusion was substantial injury to fruitlets can occur up until about 10 days after petal-fall.

Oriental Fruit Moth

Monitoring of flights of adult *Cydia molesta* in M.I.A. peach orchards was continued, in connection with an advisory spray warning service.

Terpinyl acetate lures were much more attractive to moths than were standard syrup lures, and especially valuable in the spring—detecting moths then in small numbers.

Moths from the overwintering generation began emerging just before full bloom in early September. Emergence continued until early October. Subsequent peaks of adult emergence were in the third week of November, late December, late January, late February, and late March. Warm and unusually wet weather promoted abundant late-season activity by the pest.

Dried Fruit Beetles

Further observations were made on the occurrence of adult dried fruit beetles *Carpophilus* spp. in syrup-lure traps in a Leeton peach orchard. Large numbers were trapped in late spring and early summer. The catches declined sharply at the start of heavy summer rains, and thereafter remained low.

Banana Weevil Borer

Insecticide Resistance.—In August there were reports of failure of dieldrin to control satisfactorily the banana weevil borer *Cosmopolites sordidus* in a few far-north coast plantations. Laboratory tests were then done on borers from four farms regularly using dieldrin and from a neglected plantation.

The borers from the neglected plantation proved susceptible to dieldrin and were used as a standard strain in comparative tests with borers from the four other properties.

A high frequency of resistance to dieldrin, with cross resistance to lindane, was diagnosed in borers from three of the plantations; a low frequency of dieldrin resistance was found in borers from the fourth plantation.

Survey of Insects and Mites on Citrus and Pome Fruits

A survey (started in 1966) to establish the insects and mites found in citrus and pome fruits, was continued. Collections of damaging and of beneficial species were made in the Murrumbidgee Irrigation Area in March, and in coastal districts at several times during the year; and specimens were added to displays of the insects and mites of these fruits.

For citrus the most significant finding was the common association of the beneficial wasp *Comperiella bifasciata* with red scale *Aonidiella aurantii* and/or yellow scale *Aonidiella citrina* in coastal orchards—around Sydney and Gosford. For coastal districts this is the first record of a high incidence of this parasite, although inland it is a common beneficial species in citrus orchards.

In apple and pear trees in the Murrumbidgee Irrigation Area there were striking examples of severe infestations by San Jose scale *Quadraspidiotus perniciosus*. Limbs, foliage and fruit were heavily infested. Excellent specimens were retained for display purposes.

Citrus Gall Wasp

The long-term trial of the effect of gall wasp *Bruchophagus fellis* infestation on Eureka lemon trees at Oxford Falls, was terminated. The trees were destroyed to eliminate a citrus red mite *Panonychus citri* infestation.

Incidence of gall wasp in coastal areas around Sydney remained satisfactorily low. Inland, there was increased incidence in home garden trees at Dubbo and Moree.

Citrus Red Scale

In the Murrumbidgee Irrigation Areas heavy red scale *Aonidiella aurantii* infestations continued in orchards where control programmes were inadequately used. Much fruit, especially Valencia oranges in the summer-autumn, was blemished by this pest. The parasite wasp *Comperiella bifasciata* was recorded parasitizing red scale in M.I.A. orchards at Yanco, Merungle Hill and Griffith in summer-autumn.

In lower Murray districts red scale and the closely related yellow scale *A. citrina* occur together, and natural enemy insects usually give useful assistance in their control. This assistance by natural enemies had broken down after hot weather in summer, 1968, and red and yellow scale infestations increased to above normal levels through 1968. By autumn, 1969 the infestations were reduced to satisfactory levels by effective spraying programmes.

Red and yellow scale incidence were numerous in coastal orchards but usually in insignificant quantities. The associated complex of natural enemies included *Comperiella bifasciata*.

The red scale spraying trial (applied in March, 1968 as single treatments on Valencia orange trees) was assessed in July and December. Best control was given by the standard recommendation (dimethoate w.p. 0.03 per cent plus white oil 1/100) but the following also were satisfactory: Maldison high concentrate liquid at 0.15 per cent plus white oil 1/100, and at 0.1 per cent plus white oil 1/100; omethoate e.c. at 0.055 per cent plus white oil 1/100, and at 0.03 per cent plus white oil 1/100; bromophos w.p. 0.04 per cent plus white oil 1/100; ethoate-methyl w.p. 0.025 per cent plus white oil 1/100; mecarbam w.p. 0.05 per cent plus white oil 1/100; and ethion 0.075 per cent-in-oil 1.25 per cent. The fenitrothion 0.075 per cent-in-oil 1.25 per cent was ineffective. None of the treatments caused fruit blemish.

Work in March, 1969 was restricted because of crop failure in the experimental trees. But, in a small screening trial, the results of promecarb w.p. 0.06 per cent plus white oil 1/100 compared satisfactorily with the standard recommendation (dimethoate w.p. 0.03 per cent plus white oil 1/100).

Hard Wax Scale

The hard wax scale *Ceroplastes* sp., first seen in March, 1967 at West Pennant Hills, was referred to the South African authority (G. de Lotto) for identification and determined as *Ceroplastes sinensis*.

There have been further occurrences of this scale, in the Hills district near Sydney; in troublesome infestations on oranges and mandarins. Life history and morphology of the various life cycle stages are being studied, using laboratory-cultured scales.

Citrus Red Mite

Eradication-type measures, by tree destruction or rigorous spraying programmes, eliminated the citrus red mite *Panonychus citri* infestations at Oxford Falls and Gosford—and at a Royal Botanic Gardens site to which the mite had been transplanted from Oxford Falls. No other occurrence of this exotic pest was found in surveys by the Division of Horticulture in all citrus areas of the State.

VEGETABLE PESTS

Heliothis Caterpillars

In randomized small plots of staked tomatoes at Rydalmere in January and February, sprays of carbaryl w.p. 0.1 per cent, endosulfan e.c. 0.075 per cent, trichlorphon e.c. 0.05 per cent, and dursban e.c. 0.025 per cent were compared with DDT 0.05 per cent against *Heliothis* spp. But only 4 per cent of fruit in the control plots was damaged. Under these conditions endosulfan, dursban, DDT and carbaryl provided the necessary protection but trichlorphon was less effective. Adult moths bred from infested fruits were *Heliothis punctigera*.

Cabbage White Butterfly and Cabbage Moth

In a randomized, small field trial for control of white butterfly *Pieris rapae* and moth *Plutella xylostella* on cabbages at Rydalmere in November-December, full coverage sprays of carbaryl w.p. 0.1 per cent, trichlorphon e.c. 0.05 per cent, naled e.c. 0.05 per cent, mevinphos e.c. 0.05 per cent and endosulfan e.c. 0.075 per cent, applied at 10-day intervals, were compared. At eleven days after the last application the larvae counts (twenty-five plants) were: mevinphos treated, 5; naled, 8; endosulfan, 8; carbaryl, 23; trichlorphon, 25; untreated, 36.

Another randomized trial involved misting treatments, and a medium-volume spray over the tops of the cabbages. This was at Windsor in April and May. Treatments were at 10-day intervals. The misting treatments were applied at 15 gallons and the medium volume spray at 51 gallons per acre.

Misting with methidathion e.c. 5 oz a.i. per acre, naled e.c. 8 oz a.i. per acre and DDT e.c. 16 oz a.i. per acre gave excellent control; methidathion the best.

Spraying over the tops of the plants, mevinphos e.c. 0.03 per cent and methidathion e.c. 0.03 per cent each gave good control. DDT e.c. 0.1 per cent, endosulfan e.c. 0.63 per cent, maldison e.c. 0.05 per cent and naled e.c. 0.05 per cent were not effective. In the untreated plots, 58 per cent of plants were heavily damaged, and 3 per cent undamaged.

STORED PRODUCTS PESTS

Wheat Pests

Rust-red Flour Beetle.—A survey to determine incidence of maldison-resistance in the rust-red flour beetle *Tribolium castaneum* in N.S.W. started in August. With the co-operation of inspectors (Plant Diseases Act), District agronomists and the Grain Elevators Board, samples were taken from peanut processing premises, stock feed mills, produce stores and farms. By the end of May, fifty-five samples of the beetles had been collected and established in cultures.

Forty-five samples of beetles have been tested in the laboratory. Maldison-resistance has been diagnosed in eight samples, taken from isolated country areas and the Sydney area. This type of resistance was also found in two samples of beetles intercepted in quarantine. Thirty-five samples were susceptible to maldison.

Farm Hygiene Survey.—The possible role of grain residues (in harvesting machinery and farm storage and handling equipment) as a source of insect infestation of newly harvested grain was assessed in a pre-harvest survey of wheat farms in the Tamworth district in November. Insects, mainly lesser grain borer (*Rhyzopertha dominica*), rice weevil (*Sitophilus oryzae*) and flour beetles (*Tribolium* spp.), were found in headers on seven of fourteen farms. Trucking bins and empty farm silos on all farms were free of grain and insect infestation, but some augers held grain residues containing insects.

Insect infestation of seed and feed grain stored on the farms was frequent, with the granary weevil *Sitophilus granarius* common.

The survey confirmed the importance of pre-harvest publicity about the cleaning of grain harvesting and handling equipment.

Aeration of Farm-Stored Grain.—An investigation of the merit of aeration for safe storage of grain in farm silos was started at Condobolin Agricultural Research Station in December. This is co-operative with a Departmental agricultural engineer. Three methods of controlling the amount of aeration, each applied to a silo of wheat with 2,000 bushels capacity, were compared with a non-aerated control silo. Grain samplings to detect insect infestation, and measurement of grain moisture and temperature, were made regularly.

In January the control silo had been invaded by saw-toothed grain beetle *Oryzaephilus surinamensis*, on the surface. Similar invasion occurred in one of the aerated silos where the aeration unit failed because of an electrical fault. Despite restoration of aeration in January, the latter silo was infested—throughout—by saw-toothed grain beetle in March. Slight insect infestation developed in two other aerated silos, with Indian meal moth *Plodia interpunctella* at the base outlets of one and a light infestation by saw-toothed grain beetle on the surface of the other.

After storage for almost 6 months, temperature on the surface of the aerated silos was within the range (around 65° F) at which insect development is inhibited, and at depth in the grain the temperature was about 10° F lower. Insect infestation failed to persist in the bulk of the grain in the aerated silos, but moderate surface infestation by rust-red flour beetle *Tribolium castaneum* and the saw-toothed grain beetle was found in June. A predatory bug *Xylocoris flavipes* also occurred with the stored grain pests.

Moisture accumulation in the lower portion of the aerated silos contrasted with the uniformly low moisture content beneath the surface in the non-aerated control silo. Low moisture content seemed responsible for the lack of increase in insect infestation in the bulk of the wheat in the control silo, despite considerable infestation on the surface and around the silo emptying point.

Dead adults and larvae of the Indian meal moth found at the June sampling in the augering outlet of one of the aerated silos were evidence of the effectiveness of the low temperatures achieved by aeration, in inhibiting insect development in the grain.

Export Grain Inspections.—Samples of grain from export wheat shipments were examined for insect infestation. Occasional slight infestation by rice weevil *Sitophilus oryzae*, lesser grain borer *Rhyzopertha dominica*, saw-toothed grain beetle *Oryzaephilus surinamensis*, and flour beetles *Tribolium* spp., and isolated occurrences of granary weevil *Sitophilus granarius* and the maize weevil *Sitophilus zeamais* were detected in 154 samples incubated and examined since May, 1968. The very low incidence of insect infestation confirmed, the effectiveness of maldison protectant-treatment in bulk storages.

Maize Pests

Field infestation of maize crops by insect pests of stored grain was surveyed in the South, Southwestern and Mid-western Regions in May. This is part of the State-wide survey which in previous seasons has covered maize areas on the north and south coasts, northern tablelands and mid-north coast.

Survey samples from maize in the field showed a slight infestation by the Angoumois grain moth *Sitotroga cerealella* in two crops at Gundagai and one crop at Tumut Plains. Twenty-one other samples, from crops near Tumut, Narrandera, Leeton, Griffith, Coleambally, Hay, Finley and Cowra, were apparently free of insect infestation by pests of stored grain—at the field examination. Final results will follow the incubation of the samples.

Pests in Sheepskins

Skin and Hide Beetle.—Complaints have been received from U.K. concerning cross-infestation by skin and hide beetles (*Dermestes* spp.), of cargo carried with Australian sheepskins. Local sheepskin exporters have expressed satisfaction with the normal arsenical treatment of skins. The problem was found to be due to skin and hide beetle and by ham beetle (*Necrobia* spp.) infestations in ears and folds which had received inadequate arsenical treatment and were protruding from surfaces of the bales.

External treatment of the bales of sheepskins with a residual contact-insecticide should control the problem and this is now being tested. The test was started in March and the results are not yet available. The outer surfaces of bales in two consignments of baled sheepskins were treated with diazinon, fenthion, baythion and dursban, 1 per cent dusts, and methoxy-chlor 46 per cent dust.

One consignment was shipped to Glasgow, for examination on arrival by inspectors of the U.K. Ministry of Agriculture. The other was held in a Sydney sheepskin store for local observation.

Maize Pests

Primary Sheep Blowfly

Strains Under Culture.—The following strains of *Lucilia cuprina* are being cultured, in work aimed at determining alternative compounds for use against organophosphorus-resistant and carbamate-resistant sheep blowflies.

- LS strain:** This strain, obtained from the CSIRO, Canberra, in 1956, is susceptible to all insecticides.
- DB strain:** This strain is three to five times tolerant to a wide range of organophosphorus chemicals. It is being perpetuated through females which survive 0.1 microgram of diazinon per female fly. The strain is susceptible to butacarb.
- G strain:** This strain has a resistance factor of about ten times normal to a wide range of organophosphorus insecticides. It is being subjected to pressure of 0.2 microgram of diazinon per female fly. It too is resistant to butacarb.
- O strain:** This strain, obtained from a private laboratory, was reputed to have a resistance factor in excess of the *G* strain. It is pressured with 0.3 microgram of diazinon per female fly and has a resistance factor about fifteen times normal.
- RD strain:** This strain is resistant to organophosphorus and carbamate insecticides. It is pressured with butacarb larvally, at every generation, and has a resistance factor of about twenty times normal on first instar larvae.
- TDR strain:** This strain is resistant to dieldrin and BHC but susceptible to organophosphorus and carbamate insecticides.

Laboratory Selection Studies.—Placing organophosphorus-resistant strains of blowflies under larval and adult pressure from diazinon in the laboratory has failed to select strains with a significantly high order of organophosphorus resistance. It seems that the ceiling of response to this group of chemicals is about fifteen times normal, with both larvae and adults.

The selection advance with butacarb-resistant strains to butacarb needs further study. The concentration of butacarb employed in selecting first instar larvae can be rapidly increased from generation to generation, but larvae from selected strains have a resistance factor of about twenty times normal to butacarb when tested by the standard procedure. This involves exposing larvae to cotton wool plugs impregnated with emulsions of test insecticides and blood serum.

Laboratory Screening Studies.—Forty experimental compounds, mostly organophosphorus and carbamate insecticides, were screened to find substitute chemicals for registered fly-strike preventives. Phosphonates were the most effective.

Semi-field Tests with Insecticides.—Two repeat series involving the larval implantation of sheep, at intervals from treatment with diazinon and experimental organophosphorus insecticides, have confirmed that:

- (a) The period of protection against artificial strikes is consistently shorter with organophosphorus resistant larvae than with susceptible larvae.
- (b) Registered organophosphorus insecticides will give a practical degree of protection from flystrike provided they are well applied by jetting.
- (c) Experimental phosphonates currently under test, to which *G. strain* and *RD strain* blowfly larvae have a resistance factor of about two times, are no more effective than diazinon in protecting sheep from artificial flystrikes by larvae of these strains.

Surveillance Testing.—Forty-eight blowfly cultures, from larvae removed from sheep in various parts of the Commonwealth, were tested to ascertain whether use of organophosphorus and carbamate insecticides for flystrike prevention has increased the order of resistance to these chemicals. Results in the 1968–69 season reveal that the ceilings of resistance in field populations of the blowfly have remained static, at about fifteen times normal against organophosphorus chemicals and at about twenty times normal against butacarb. This is consistent with the results from laboratory selection programmes with diazinon and butacarb.

DOMESTIC PESTS

Argentine Ants

A television publicity campaign, supplemented by radio and newspaper coverage, was responsible during the summer for submission of over 15,000 samples of ants—mainly by children—and the discovery of seven new areas of Argentine ant *Iridomyrmex humilis* infestation covering some 131 acres. In 1966–67, thirty-one new areas of infestation were found when a similar publicity campaign in summer yielded near to 15,000 samples of ants.

Since the first report in 1950 there have been 310 areas of infestation found in the Sydney, Wollongong and Shellharbour areas. Total of areas of infestation has amounted to 7,510 acres. This year's result has given promise that the end of the eradication campaign is in sight.

In all, 131 acres of infestation (in seven separate new areas) were sprayed this year; with 15,285 gallons of 2 per cent chlordane. Three areas of infestation remain to be sprayed.

So far, 7,463 acres of infestation have been sprayed in the eradication campaign.

In a first-time survey of twenty-four areas of infestation which have been sprayed, involving 958 acres on 1,009 properties, Argentine ants were found in one location in each of three separate areas of infestation. Two of these have been sprayed and the other will be sprayed shortly.

UNUSUAL OCCURRENCES

Rutherglen Bug Plague

Rutherglen bug *Nysius vinitor*, a native insect, is sporadically important in spring-summer. This year it occurred over most of the State, in the most severe plague for more than 20 years. Coastal districts were affected in the period September to December. In the north western inland the plague started in mid-October and ended in early January. In central western and south western areas severe infestations started in November-December and in some districts persisted until February. Extremely dry conditions prevailed in coastal areas in winter and spring, before and during the outbreak, but in inland areas the plague followed good autumn and spring rains.

Crops of many kinds were infested. On some of these, including wheat and lucerne, the bug's significance as a pest was not clear. However, many crops were seriously damaged. Vegetables, including potatoes and carrots, and stone fruits and strawberries were the most severely affected.

In the MIA, nymphs and adults were numerous in the spring on the abundant weed growth resulting from good autumn and spring rains. Swarming adults appeared in late November and in the following weeks they attacked ripening stone fruits; especially apricots, plums and prunes. Infested fruits were pitted and showed pockets of hard tissue, in association with gumming. An estimated 75 per cent of MIA stone fruit orchards suffered important damage. The damage varied greatly between orchards and in different sections of the one orchard.

Because of continued re-infestation by the winged adults control was difficult. Frequent, repeated insecticide applications were needed. It was reported that maldison generally gave good results, with a quick knock-down effect.

In late autumn the bugs were readily found in small numbers on flower heads of weeds such as *Erigeron* sp. and *Verbena* sp. in coastal areas.

A laboratory culture of Rutherglen bug has been established, fore-runner to dosage-response testing with a range of insecticides.

Plague Thrips

For the second year in succession a severe outbreak of plague thrips *Thrips imaginis* occurred from September to November. The plague was widespread; in almost all inland fruit growing areas and in many parts of the coast. Blossoms of a wide range of plants were infested. The most serious damage was on apples, nectarines, strawberries and roses.

Apples were attacked in the "pink" and early flowering stages. Where no effective control measures were adopted, the cropping (particularly of Granny Smiths) was greatly reduced and sometimes entirely prevented. Most growers made two to four applications of DDT to control the outbreak.

In nectarines, the thrips fed beneath the remains of the flowers and caused severe fruit russetting where not controlled. Strawberry flowers were infested, causing failure of setting. Pale-coloured varieties of roses were very heavily infested, the buds often failing to open.

The thrips were also a considerable nuisance to householders by swarming onto pale-coloured washing on clothes lines, and on to pale-coloured garments—then often causing some skin irritation to the wearers.

SYSTEMATIC STUDIES

The Insect Collection

This year 26,133 insects were added to the Collection. The specimens were in a wide variety of insect Orders. A great deal of material from storeboxes was incorporated.

Use of the unit tray system of arranging pinned specimens was started, on the Order Hemiptera, to determine its practicability and value for the Collection. Seven drawers, containing 748 specimens of Fulgoroidea, Cercopoidea and Cicadidae, were arranged in trays.

Taxonomy of Scale Insects

Much progress was made in the last 6 months in study of the taxonomy of scale insects, Coccoidea; armoured and soft scales. New material was added to the Collection, and mounted specimens dating to 1930 in the Collection have been examined and re-organized.

Study of Curculionidae

A total of 5,225 specimens was added to the Collection, in the following sub-families of Curculionidae: Brachyderinae (1,006), Sitoninae (119), Oriorhynchinae (193), Eremninae (237), Leptopinae (1,184), Cyliodrorhinae (210), Rhytirhinae (278), Rhyparosominae (1), Diabathrariinae (2), Amycterinae (96), Gonipterinae (30), Rhadinosominae (6), Cleoninae (34), Hylobiinae (55), Eribrinae (619), Aterpinae (69), Amalactinae (38), Anthonominae (19), Laemosaccinae (14), Haplonychinae (48), Cryptorhynchinae (220), Rhynchophorinae (90), Cossoninae (149), Unclassified (515).

Of families formerly considered sub-families of Curculionidae, specimens added were: Belidae (45), Attelabidae (16), Apionidae (49).

Chemistry Branch

STAFF

Post-Graduate Studies

Chemists Miss L. Hilton and Mr T. Abbott are on study leave at the University of Sydney and Mr D. R. Leece in the U.S.A.

Overseas Study Tours

Chemist Mr M. G. Chatfield returned from an overseas study tour and his report "Overseas Consultations on Water for Stock and Irrigation, and Soil-Water-Plant Relationships" has been published. Mr F. W. Cradock made an overseas tour to study plant nutrition problems and Mr I. Vimpany began a tour in relation to potassium studies.

CEREAL CHEMISTRY SECTION

Laboratory Output and Statistics

Grain and Flour Samples.—Samples received totalled 3,102 as against 1,672 in the previous year. The big increase reflected the record wheat crop, the harvesting of all trials, the much greater total of samples from the Grain Elevators Board in connection with the silo survey, the running samples in connection with the premium pool, and also more samples from the northern breeding programme centred on Tamworth Agricultural Research Station.

Range of Physical and Chemical Tests.—Protein determinations totalled 3,592, a drop of 300 from the preceding year; 393 ash determinations were made on flour, and 759 standard oven moistures were determined on flour and other grains. Farinographs totalled 414 and extensographs 298; normal totals. Because of increased interest in grain hardness studies, some 1,156 pearling resistances were undertaken; a big increase on the 724 of last year.

Of the sample receivals, 160 were from Plant Breeders' trials, 257 from Departmental 1/40th acre trials, 711 from farmers' variety trials and 73 bushel samples were received for Uniform Quality Testing. All of these, being of pure varieties and crossbreds, get such standard tests as bushel weight and 1,000 kernel weight and rapid moisture determinations.

Milling and Baking.—The test loaves baked and assessed totalled 1,522, and 968 units were milled in the Buhler experimental mill. The significant drop in experimental milling was due to staff involvement in measurement of dust in export wheat, and also export certification of rice.

The 1968-69 Wheat Crop

The 1968-69 harvest created another production record for New South Wales. Production statistics are in the Division of Plant Industry section of this Report.

Five Grades Declared.—For the first time, five grades were declared for the current harvest: Prime Hard, Northern F.A.Q., Southern/Western F.A.Q., Light Weight Prime Hard, and New South Wales Off-Grade. The wheat is bright and attractive although the standard bushel weights declared were lower than in the previous season.

Protein Levels.—These did not reach the record heights of the previous season's grades. The Prime Hard and Northern F.A.Q. were close to 1 per cent lower than the respective 15.7 and 13.7 of the previous season. Southern/Western F.A.Q. had 11.8 per cent as compared to 13.8 per cent in the previous season.

Protein Content—Silo Survey.—Each year a representative sample is received from each receival point in N.S.W. Grain Elevator System, examined for protein content and submitted to other small scale tests.

The total of 239 samples this year reflects the lowering of protein levels already mentioned. In the previous year's receivals, 120 of the silos had protein levels in excess of 14 per cent whereas this year sixty-eight silos (40 per cent) had protein levels in excess of 13 per cent protein and sixty-eight silos—as against only sixteen a year earlier—had proteins below 12 per cent.

North Western Wheat Breeding

Because of staff shortage in the cereal laboratory at Tamworth Agricultural Research Station, the Chemistry Branch gave priority to testing of a number of advanced lines from nine trials of the Tamworth breeding programme, and subsequently discussed with the breeder the prospects of the lines in the trials.

Export Certificates

General.—Exports of wheat and flour were slow in the latter half of 1968 but, after the big 1968-69 harvest, increased in the first 6 months of 1969. Of the ten flour shipments certified, eight were in the latter 6 months.

Seventeen wheat shipments were certified, seven from Sydney and ten from Newcastle. The total of countries requiring certificates of quality is increasing. Seven ships were certified for China, five for Chile, two for Colombo, one for Philippines, one for Peru, and one for Taiwan.

The cereal chemistry section was called on also to certify a ship load of rice to India and one of sorghum to Japan; the latter a trial shipment that may lead to a regular trade.

Export Wheat.—One hundred and twenty-three ships, seventy ex Sydney and fifty-three ex Newcastle, carried New South Wales wheat to many countries of the world. Some shipments included four different grades.

Some 209 separate lots covering the five available grades were exported in the 12 months. A running sample of each of these was received; a weighted composite was prepared and physical and chemical analyses undertaken on each final sample. The samples were drawn from three harvests; fifteen being from the carry-over of the large 1966-67 harvest, sixteen from the 1967-68 harvest, and 125 from the 1968-69 harvest. The analyses of samples from the last two harvests are to be mathematically analysed to check on sampling errors and variation within the crop year.

In the shipped wheat was a tonnage of durum exported to Kuwait; the first recorded shipment of the macaroni type in the last 60 years and possibly the first ever.

Dust in Export Wheat.—Measurements of dust in bulk wheat were undertaken; and some preliminary observations made towards determining the causes of dust occurrence there. Samples of export shipments were examined after the movement of bulk wheat through the handling equipment at the Sydney Terminal, and sampling was also done in the ship holds to measure the variations likely.

It appeared that the dust is almost wholly from the grain itself, and comprises mainly epidermis and the brush hairs of the grain.

The level of dust, on preliminary findings, relates to a number of causes. Amongst these is the low level of moisture in Australian wheat, the mixture of hard and soft grains that occur in our F.A.Q. shipments, and the varietal make-up of the parcel of grain.

Some varieties seem to lose their epidermis easier than others. This appears related to grain shape, and smoothness of the outer layers of the grain.

R.A.S. Wheat Judging

The R.A.S. judging for Wheat (Open Classes) was done in the laboratories of the Chemistry Branch. Through demands on staff, associated with rice exports, and an increase in wheat sample receivals for analysis, the Show judging was only accomplished by the voluntary staggering of working hours by staff.

N.S.W. Standing Advisory Committee on Wheat

The regular annual meeting of this Ministerial Advisory Committee, whereof the Cereal Chemist is a member, considered alterations to the sowing recommendations for the 1969 wheat season—including recommendation of the newly registered crossbred N.B.J. 115 named Wren. Wren was recommended for higher rainfall areas of the southern and western areas of the State, and for the southern irrigation areas.

The Standing Advisory Committee rejected the recommendation of Wren, and this decision was later ratified by the Minister for Agriculture. The Australian Wheat Board felt that further increase in Heron-type wheat would make more difficult the selling of the Southern/Western F.A.Q. product.

Milling data showed the Committee that Wren was equivalent to Heron in flour yield and that both were inferior to the free-milling variety Olympic grown at comparable locations over a few seasons.

Effects on the experimental flour-yield of a South-Western blend with increasing additions of Wren were measured on samples taken from four agricultural regions in two seasons. When Wren formed 80 per cent of the final blend, flour yield was slightly depressed.

Uniform Quality Testing of Wheat

The Uniform Quality Testing Sub-Committee.—This was convened twice by the Cereal Chemist this year. For the October, 1968, meeting the Committee had three items to consider: (a) crossbred A.R. Falcon 28A; (b) a further hard, good quality wheat from the Temora breeding programme; and (c) a direction from the Standing Advisory Committee on Wheat to investigate further the crossbred N.B. Javelin 115 (i.e., Wren).

It was agreed that A.R. Falcon 28A is a promising crossbred, but at the upper level of grain hardness and that breeders should take note of this important grain character.

The other crossbred was considered suitable for a further year's testing.

Concerning Wren, the committee considered that, the previous report to the State Wheat Improvement Committee being factual and a correct assessment of the crossbred's quality, no purpose would be served in further uniform quality testing the variety.

That previous assessment report on the quality of Wren by this committee read as follows:

"The committee agreed that crossbred N.B.J. 115 is a soft wheat that is not as free milling as Olympic. In this regard it is more comparable with Heron, having similar flour yields on the Buhler mill and both being somewhat difficult to reduce to flour. The view was expressed that not enough attention is being given to the free milling character of soft wheats, particularly as this is an important attribute of Australian wheats.

"The crossbred has a higher water absorption than Olympic, was inclined towards stability in its dough characteristics as is Olympic and has a baking capacity at least equal to Olympic. It has a lower water absorption than Heron, was less extensible than Heron, but has superior baking quality when compared with that variety.

"The crossbred is unsuitable for biscuit production. Overall, when all quality factors are considered the committee was of the opinion that N.B.J. 115 (Wren) is comparable with the standard variety Olympic and if anything superior to the variety Heron."

At the June, 1969, meeting the Uniform Quality Testing Sub-Committee considered the results of collaborative testing of two advanced crossbreds from the University programme and one advanced crossbred from the Tamworth breeding programme.

On the University crossbreds TR236 and TR207, the committee opinion was that both lines were of good potential and worthy of further testing.

On the Tamworth line, there was division within the committee on the potential of this crossbred due to its dough qualities being of a tougher type as measured on the instrument measuring dough-extensibility. The committee decided to further test this line in 1970.

Flour Particle-Size Studies

Some experimental work relating the flour maltose value to flour particle size, and to flour viscosity as measured by the Amylograph, was finalized and published. The work ventured into the field of alpha amylase activity and weather damage in wheat.

Studies are continuing in flour particle size and the factors which influence it—such as variety, protein level, environmental factors, and milling technique.

New Equipment

Two major items of equipment acquired this year were a new chemical balance for measurements in small-scale testing such as 1,000-grain weight and pearling resistance, and a new air oven with an internal fan and rapid temperature recovery,

allowing increased output of standard moisture determinations—with less error. Other new equipment included loaf-volume measuring apparatus for the test bakery, indented from U.S.A.

Rice Export Certifications

The Chemistry Branch was required to certify a shipment of 10,000 tons of polished rice to India. The detailed procedure laid down by the purchaser involved M.I.A. field staff of the Division of Horticulture in sampling 2 per cent of the bags comprising the shipment. The Indian Government flew out a representative to examine the shipment and certification procedures.

With no specific instrument available to separate the varying portions of broken and whole grains, staff were involved for long periods in counting and weighing small broken particles of rice. Specifications for the shipment defined admixture as including broken particles of rice less than one-quarter the size of a whole grain. Therefore, it was necessary in the first instance to set a standard for a whole grain.

Grain Sorghum Determinations

Collaborative with the Queensland Wheat Research Institute, a series of grain sorghum moisture determinations were done in November, 1968. Whole and ground samples were tested on the same days in both institutions—using a number of different standard methods, including those adopted by the International Association of Cereal Chemists, but seemingly not effective for grain sorghum.

Importance of the work is in the fact that export markets for this crop seem to be increasing, and certificates of quality will probably be sought by importing nations. Moisture content would be a normal component of a certificate.

It is appropriate to report, also, that the Queensland Wheat Research Institute has been included in the Uniform Quality Testing scheme for wheat. The Institute, whilst an active participant in the testing of material, is an observer only—so far as Committee discussions and decisions are concerned. The Queenslanders gain, earlier than otherwise would be so, an indication of the quality potential of varieties that may emerge from this N.S.W. breeding programme and might be grown in Queensland's wheatbelt.

Professional Visitors to the Cereal Chemistry Section

Mr J. Leslie, Director, Queensland Wheat Research Institute, Toowoomba, visited in April, 1969, for the discussions concerning closer collaboration in the testing of advanced wheat lines.

Dr Russell Tkachuk, a Research Officer with the Board of Grain Commissioners, Winnipeg, Canada, visited to discuss cereal research problems. Widely known by cereal chemists for his publications on wheat and flour proteins, he is doing post-doctoral research at St Vincent's Hospital, Melbourne, on the sequential arrangement of amino acids in proteins.

In-Service Training

A Research Officer (Cereal Chemistry) and a Technical Officer (Scientific), who will be doing the cereal chemistry at Tamworth Agricultural Research Station, each spent 3 months in the Section before proceeding to Tamworth to concentrate on assessment work for the North Western Wheat Breeding Programmes.

The newly-appointed Rice Chemist for location at Yanco Agricultural College and Research Station spent 6 months in the Section, partly working on rice quality assessment methods; and a trainee laboratory assistant who will assist him at Yanco was given 6 months' training in the laboratory techniques.

PESTICIDES SECTION

General and Methodology

Volume and variety of work handled by the Section increased, especially the residue studies with plant and animal products.

The apple and pear spray residue investigations operating under a Commonwealth programme were terminated in December, 1968, when the associated chemist retired. Apple and pear studies would now be in the general residues programme of the Section.

A graduate chemist was appointed in May, 1969, to augment staff engaged in residues investigations, after the aforementioned retirement. Two vacant assistant positions were filled and the recruits are being trained in residue techniques.

Equipment purchased with funds from the Commonwealth Extension Services Grant has increased the facilities to study residues and formulations. Use of the infra-red spectrophotometer has been further extended, by applying a potassium bromide disc technique to the quantitative analysis of formulations. Use of mixed bed columns, prepared by methods developed in the Chemistry Branch, using efficient support materials, has improved the separations of pesticide mixtures on the gas chromatograph.

Chlorinated Pesticide Residues in Eggs

Investigations followed the N.S.W. Egg Marketing Board's detection of significant residues in eggs. The offending producer was identified in each case, and Departmental field officers looked for the source of contamination. Samples of eggs and feed components were analysed for hexachlorobenzene, DDT, and other pesticides.

Wheat, and feed containing wheat, has been the usual source of hexachlorobenzene contamination, probably through seed-wheat treatment. DDT contamination has come mainly from DDT treatment of areas accessible to poultry. In one case, grain sorghum was found to be a source of DDT contamination.

Degree of translocation of hexachlorobenzene occurring in wheat crops grown from treated seed is also being studied. Samples of grain from the N.S.W. 1968 wheat crop have revealed only extremely low residues.

Pesticide Residues in Beef Cattle from Cottonseed

Whether any pesticide residues found on cottonseed products fed to stock will accumulate excessive residues in animal tissues is being investigated. Cottonseed meal is likely to be increasingly used in livestock nutrition, particularly pigs and beef cattle, due to the rapid increase of cotton acreage.

Analyses of cottonseed meal have indicated only very low levels of DDT and endrin residues. The results so far do not indicate a serious hazard.

In a trial conducted at Trangie Agricultural Research Station, beef cattle were fed for up to 6 months on diets containing 15–30 per cent cottonseed meal averaging 0.04 ppm DDT. Other feed components, wheat and hay, averaged 0.013–0.015 ppm. Subcutaneous fat samples at the end of the trial showed slightly higher DDT levels in animals fed cottonseed meal than in control animals. The DDT residues were well within accepted world-tolerance levels, but final assessment awaits the analyses of samples from two other fat sites.

Dimethoate/Thiabendazole Banana Residues

Dimethoate and thiabendazole (TBZ) dips have given good control of Queensland fruit fly, and of blackend and squirter diseases of bananas. Experiments at Gosford Citrus Wastage Research Laboratory investigated the residue levels in the fruit after dipping with mixtures of the two pesticides. Fruit were dipped for various times (10 to 160 secs), and single component dips were used for comparison.

The mixed dip gave similar residue levels to those from the single component dips. The lowest dip-time tested (10 secs) gave lower TBZ residues, while dimethoate residue was unaffected. A 30 sec dip-time will probably be adopted in practice.

Dimethoate residues were 0.31–0.67 ppm in whole, ripened fruit and 0.05–0.07 ppm in pulp. TBZ residues were 2.7–4.9 ppm in whole fruit and not detected (less than 0.02 ppm) in pulp. Australian tolerance for dimethoate and TBZ (temporary) on whole fruit is 2 ppm and 10 ppm respectively. So, the results indicate no excess residue problem for fruit consumed in Australia.

Thiabendazole Banana Dips

TBZ is likely to replace salicylanilide for the post-harvest treatment of banana fruit. It has wider biological efficiency against blackend and squirter diseases of bananas.

TBZ dips have been examined under conditions of commercial usage to determine their limits of efficacy and stability

over a range of concentrations (including 200 ppm, tentatively registered for dipping bananas). From this work, dipping recommendations will be compiled for the banana industry.

Thiabendazole Residues in Fruit

Further small-scale experiments have been done to find what residue levels are likely from post-harvest treatment of bananas and oranges in TBZ dips. The data were required by the National Health and Medical Research Council (N.H.M.R.C.) for the setting of an Australian tolerance for TBZ residues in banana and citrus fruits.

The dippings were done at Gosford Citrus Wastage Research Laboratory, using suspensions ranging from 0.02 to 0.32 per cent TBZ. Residues in oranges were 0.49–1.68 ppm TBZ (whole fruit), but no residue was detected in the flesh. Banana residues were 0.7–12.0 ppm (whole fruit) and 0.03–0.20 ppm (pulp).

A tentative tolerance of 10 ppm has been set by the N.H.M.R.C. for whole banana and citrus fruit.

Also, the levels of TBZ deposits on green bananas following simulated commercial dipping at Alstonville Tropical Fruit Research Station have been studied. TBZ dip concentrations ranged from 5 ppm to 0.3 ppm TBZ.

Since 0.02 per cent TBZ dip concentrations will now be used in practice, American or Australian residue tolerances allowed on whole fruit are not likely to be exceeded.

Maldison Residues in Eggs

A trial at Glenfield Veterinary Research Station investigated hazards associated with feeding high levels of maldison to laying hens. Wheat silo dust, a component of commercial feeds, has been reported to contain up to 1,000 ppm maldison.

Hens were fed continuously for up to 13 weeks on a diet containing up to 2,600 ppm maldison. Eggs and body fat samples, taken at intervals showed no significant residue of maldison or the toxic metabolite, malaaxon. The results indicated negligible residues hazard when high levels of maldison are fed to laying hens.

Quality of Dieldrin Formulations

Many complaints about inability of dieldrin to control the banana beetle borer led to examination of the quality of all commercial formulations sold to banana growers. No case of dieldrin content lower than that claimed on the label was found. But most of the formulations produced very unstable emulsions.

Emulsifiability and emulsion stability were tested by a developed method based on infra-red spectroscopy coupled with specific sampling procedures. It permitted accurate determination of the dieldrin content of emulsion fractions, and thus more reliable assessment of emulsion stability than by the usual visual inspection methods.

Banana growers often allow many hours to elapse before applying previously prepared emulsions. This, and the poor emulsion quality, leading to uneven distribution of the dieldrin, could explain unsatisfactory control of the beetle borer.

Herbicide Phytotoxicity

Phytotoxicity problems in the M.I.A. are being caused by certain crop rotation practices associated with increasing use of persistent herbicides. As rotations become more complex, the cropping systems possible may be dictated by the herbicide residues in the soil.

Farmers need to know whether persistent herbicides can carry over from season to season, or from crop to crop, to avoid phytotoxicity in subsequent crops. One situation is that of rice following maize; maize being very tolerant and rice very susceptible to atrazine.

Methods of analysis by infra-red spectroscopy and bio-assay are being developed to measure atrazine persistence in M.I.A. soils. Various formulations and cropping procedures will be examined for effect on persistence.

Mercury in Eggs

Some organic mercurial fungicides are used to treat seed wheat. There is a risk that treated wheat might be fed to poultry and cause mercury residues in eggs.

In an experiment at Glenfield Veterinary Research Station, laying hens were fed for periods of up to 7 weeks on diets containing two commonly used mercurials.

Several analytical methods for the determination of mercury residues in eggs and other tissues and feeds have been investigated. A more rapid and more specific procedure has been developed for use in the aforementioned trial.

Miscellaneous

A number of samples involved in cases of plant or animal toxicity have been examined. Arsenic was a commonly found contaminant. The cases included: water killing a number of cattle; damage to a banana plantation; sterile soil; and damage to rose bushes. Arsenic was found also in poultry manure which used as a fertilizer, had damaged vegetable crops.

Specimens from two dead frog-mouthed owls submitted by the National Parks and Wild Life Service were examined for the presence of pesticides. Dieldrin residues were found as follows: stomach contents 3.8, 4.3 ppm; intestine 7.9, 8.6 ppm; liver 9.5, 14.6 ppm.

A number of chemicals were submitted for identification. Infra-red spectroscopy identified them as: adipic acid, gelatine, ammonium nitrate, sodium carbonate, lysol, silica powder and diesel oil.

WATERS, REGULATORY AND GENERAL SECTION

Water Analysis

The water analysis and advisory services of the Chemistry Branch functioned efficiently, providing information and advice on the salinity status of irrigation and stock waters and analytical data about likely hazardous components.

This service, one of the Department's oldest, continued to expand its authority on the very many factors affecting safe use of waters for primary production and in industry associated with agriculture.

The partially decentralized water testing services, in the nine Agricultural Regions and two major irrigation districts of the State, found continued support from landholders and the Water Conservation and Irrigation Commission. The decentralized simple analyses provide a fast and readily available service, especially valuable in time of drought but also in minimizing expense and delays during bore sinking. Use of inferior or marginal waters for irrigation can be avoided to some extent by using the quick service.

Usage of the decentralized service is indicated by the fact that this year the 4,235 water and soil tests comprised 3,692 done at decentralized offices, in the Regions, and 543 at Rydalmere. Of the 3,692 tests at country centres, 3,366 were water samples.

Special notes from Regional Supervisors included such matters of interest as: at Maitland, increased number of samples from the Farm Water Supplies Branch of the Water Conservation and Irrigation Commission—suggesting more use of W.C. and I.C. services by farmers in the design of irrigation schemes; samples from the Paterson River, tested for the Dungog Shire Council Engineer to assist in planning a proposed water supply for the town of Paterson; samples from the Williams River tested for the Hunter Valley Research Foundation's investigations; at Dareton, many samples of Murray River water (from Swan Hill to Curlwaa) during the irrigation season—detecting salt flushes moving down the river, and allowing irrigators to avoid using the water at these periods; and, in co-operation with the Victorian State Rivers and Water Supply Commission, the publication of daily salinity levels in the area newspapers.

Problem Waters and Pollution

Soluble iron salts in surface streams, wells, dams, and shallow bores posed some problems for irrigation and rural domestic supplies. Precipitation of iron on leaves, blossoms, and fruits in orchards during spray irrigation caused concern. Damage, particularly to blossoms and affecting fruit set, was occasionally significant.

In one instance, sprinkler irrigation after Bordeaux spraying caused rapid precipitation of iron on all parts of the trees. The Bordeaux by raising the pH of the wetted portions contributed to the precipitation and oxidation of soluble ferrous salts present.

In another instance, controlled dosage of bore water with slaked lime slurry before the water entered an irrigation dam was necessary. This rapidly precipitated the iron from the water. The pH of the treated water was approximately 7.5 after complete removal of the iron.

Algal Contamination of Water Supplies

In co-operation with the Royal Botanic Gardens Honorary Algologist Mrs V. Jones, a number of samples of water suspected of pollution by algae toxic to stock were examined. The waters' nitrate, phosphate, and hardness levels—parameters associated with algal development—have been determined, and will be continued because of evidence in a particular water source that nitrogen-fixing algae there appear to continue fixation (in samples collected in glass containers) for a considerable period after sampling.

"Drip/Trickle" Irrigation

Stimulated by results in Israel and demonstrations in Australia, and the expressed interest of irrigators in information on "drip/trickle" irrigation techniques, plans are in hand to test its application to row crop cultivation of cabbages.

Israel's results have shown it to be satisfactory for a range of fruit trees and a number of row crops—including tomatoes, melons, cucurbits, and peppers. Its satisfactory adaptation to cruciferae, potatoes, etc., could mean high density cultivation and overall water conservation.

Seminars, Overseas Study Tour, and Lectures

Seminars.—Personnel of the Waters Section attended a seminar in Adelaide on "Technical Aspects of Saline Water", conducted by The Water Research Foundation of Australia, and a Canberra seminar, on Arid Lands, under the aegis of the Australian Academy of Science. Valuable liaison with interstate and overseas scientists was established.

Overseas Study by Waters Chemist.—A report called "Overseas Consultations on Water for Stock and Irrigation and Soil-Water-Plant Relationships" by Waters Chemist Mr M. G. Chatfield has been processed and will shortly be available for limited distribution. Mr Chatfield consulted some 125 scientists overseas; in U.S.A., U.K., The Netherlands, and Israel.

Besides the report he has prepared a catalogue of 370 documents and reprints of current scientific research brought back; for ease of reference by interested departmental personnel.

Lectures.—Lectures on water quality and irrigation were given at a number of Agricultural Bureau conferences/field days and others organized by the Department; also to the Australian Water and Waste Water Association—on pollution problems and their agricultural significance.

Analyses of Stock Feeds and Medicines

For several months the Regulatory Chemistry Section functioned without a full-time chemist. Necessarily, the usual quality surveys of products registered under the Stock Foods and Medicines Act were reduced, but a number of registered stockfeeds were analysed in detail in light of complaints of poor quality or performance. These investigations resulted in warnings to manufacturers in appropriate cases.

The recent appointment of an experienced graduate chemist should ensure satisfactory restoration of the important regulatory function.

Collaborative Projects on Feedstuffs

Choline in Broiler Diets.—Recent work to determine optimum levels of choline for broiler chickens has been evaluated statistically and will shortly be published in a paper "Choline Requirements of Broiler Chickens". It was collaborative work by officers of the Chemistry Branch and the Seven Hills Poultry Research Station.

A recent paper by the same authors, highlighting certain aspects of this investigation, showed that under some circumstances choline chloride supplementation of broiler diets at the rate of 400 mg per lb led to symptoms of toxicity. The current work indicated that supplementation at the levels commonly practised in some commercial feeds may not be justified.

Composition of Australian Feedstuffs.—Completion of a survey of the composition of variety of feed ingredients available in N.S.W. was followed by a paper presented at the Australian Poultry Science Convention, in Queensland, May, 1969. This survey provided analytical data, including major and trace minerals, from almost 200 samples of twenty commonly used feedstuffs (grains, grain by-products, meals of plant and animal origin, and dairy by-products) and sixteen miscellaneous products.

The tabulated results include suggested minimum values for use in feed formulation, based on mean and standard deviation figures obtained. Little reliable information had been available previously on the mineral composition of such a wide range of local feedstuffs. Thus these data should be especially valuable to nutritionists and feed formulators.

The Standing Committee on Agriculture, in view of the need to collate data on the composition of feedstuffs available in Australia, has sought this Department's advice and co-operation with a view to introducing a system of classification of animal feeds. This would provide systematic collation of obtained information on the source of feedstuffs, and analytical data determined by standard reference methods. A Chemistry Branch officer will shortly attend special meetings concerned with the uniform classification system.

Studies on Oils and Fats

Following recent appointment of a chemist for specific study of the chemistry and analysis of oils and fats, methods for detailed examination of composition of oils, fats, and admixtures have been further developed.

Cooking Margarines.—These are now being checked regularly for conformity with Dairy Industry Act requirements. Most have been found to comply with the Act's specification that cooking margarine shall contain at least 90 per cent of animal fats. In a few instances, slightly more than the permissible amount of vegetable oil was detected.

Oil Seed Crops.—Samplings from oil seed crop trials being conducted in the north west are to be examined by gas chromatographic methods. Soybean variety trials are currently being conducted at Narrabri, and the quality of oil from the harvested crops will be examined. Similar studies will apply to oil from recent cottonseed trials.

Ruminant Nutrition Research.—Preparations are in hand to examine the volatile fatty acids in rumen liquor; in association with a Ruminant Nutrition Research programme at Wollongbar Agricultural Research Station. This analytical data, basic to much of the work at Wollongbar should help to explain the production-differences between various animals grazing different pastures.

PHYSICAL CHEMISTRY SECTION

X-Ray Spectrometer and Diffractometer Acquisitions

For a long time there has been action towards purchase of x-ray spectrometry and diffractometry equipment for the Chemistry Branch. Now orders have been placed for a simultaneous automatic x-ray spectrometer and diffractometer equipment. The equipment, as with the atomic absorption spectrometer and other comparably complex instruments, will operate under the supervision of the Physical Chemistry Section of the Branch. Preparations for installation and commissioning of the units have increased in intensity this year.

Atomic Absorption Spectrophotometry and Supplementary Equipment

Some 2,400 plant samples and soil extracts were analysed for calcium, magnesium, manganese, sodium, potassium, zinc, copper and iron.

Programmed upgrading of the instrument was rounded off by the purchase of the remaining components of the Varian Techtron model AA4 unit. So, all of the original has been replaced and a complete model AA4 is now in use—together with the burner assembly for the later AA5 model. This burner assembly has vertical, horizontal and rotational setting controls superior to the AA4 unit and, with a new Titanium burner head, will allow satisfactory analysis of solutions of higher acid concentration. This will enable analysis to be done on a modified Kjeldahl wet digestion solution of plant material for potassium.

With purchase of an automatic colorimetric analysis system, analysis of this same digestion solution for nitrogen and phosphorus is planned.

A new micro diluter and pipetter has assisted and greatly improved the efficient preparation of dilutions.

Free Energy and Soil Potassium

A paper has been drafted for publication, incorporating observations from free energy measurements related to the potash research programme. The officer (Mr I. Vimpany) of the Chemistry Branch Soils Section with whom the overall

responsibility for this programme lies, has discussed with appropriate experts overseas (and especially in the U.K.) the Branch contributions to the application of free energy considerations to potash nutrition of plants. He has reported that these contributions have aroused a lot of interest.

It is now apparent that potash nutrition is a much more complex subject than was originally conceived. Before tests to predict effectively the potash needs of soil can be devised, a far greater nearer-to-complete understanding of the involved processes is essential.

PLANT NUTRITION SECTION

New Methods Developed

For Determinations on Liming Materials.—Calcium and magnesium determinations in limestone, magnesite and dolomitic materials have traditionally been cumbersome. Originally these were by gravimetric procedures. Then EDTA methods were introduced and have been used for the last 15 years. EDTA methods were much faster, but determining the end point could be difficult unless an operator worked continuously at it.

This year methods of determining calcium and magnesium in fertilizers have been adapted to atomic absorption. Previously these determinations on atomic absorption were difficult because of the instrument's excess sensitivity—as it was set up for plant analysis. Concentration of magnesium and calcium was generally too high.

By setting up the burner at right angles to the light source instead of passing the light along the full length of the flame, and by using a special set of standards, satisfactory determinations of calcium and magnesium in these materials are now possible.

For Nitrate Determinations.—Nitrate status of grasses is an important factor, affecting mortality of grazing stock, particularly with increasing use of nitrogenous fertilizers.

In co-operative projects at Narrabri Agricultural Research Station and Temora Agricultural Research Station, the effects of nitrogen fertilizers on pasture composition have been studied in the field and laboratory. These projects, and another on cotton nutrition, necessitated nitrate analysis of a broad range of plants.

Available methods of nitrate analysis were examined and found to be slow, inaccurate and generally unsatisfactory. A study to develop an acceptable nitrate analysis technique has been completed.

The developed method is simple to use, fast and accurate, and already in general laboratory use in the Plant Nutrition Section of the Chemistry Branch and at Narrabri Agricultural Research Station.

An article explaining the theory and applications of the method has very recently been submitted to "The Analyst", *Journal of the British Society for Analytical Chemistry*.

Nitrates in Cotton

Effect of rate of application of nitrogenous fertilizer on nitrate levels in the cotton petiole and on cotton yield has been studied.

The work has shown that in cotton the nitrate content of the petiole of the most recently matured leaf is a guide to cotton yield and to nitrogen fertilizer requirements. A joint paper on this subject was read at the first Australian Cotton Research Conference (March, 1969). Other observations (by Messrs Paull and Milham) relating rate of nitrogen application to other factors—date of maturity, seed yield, seed protein and oil content—have been made. These data are awaiting statistical analysis.

Zinc Deficiency of Cotton

The first case of zinc deficiency in a N.S.W. commercial crop of cotton has been reported, and substantiated by field trials and chemical tests.

In the 1967-68 season, symptoms consistent with zinc deficiency of cotton

(interveinal chlorosis, brittle, thickened leaves with up-turned margins, followed by leaf shedding in more severely affected plants, shortened internode length and delayed maturity accompanied by a high shedding rate of early matured bolls)

were seen in the majority of plants on a crescent shaped area denuded of the top 15 inches of soil by land-levelling.

Irregular shape of the affected area prevented suitably designed field trials but selected rows were given a foliar zinc sulphate spray. Recovery was visible within 1 week of treatment, but the untreated plots also recovered—after 4 to 6 weeks.

Similar growth deformities occurred in plants on the same site in 1968-69, the following season. Field results of zinc treatments will soon be in hand. Chemical analysis of plants from the affected area has shown that their zinc content is inversely related to the severity of symptom expression, i.e. healthy (greater than 20 ppm Zn), mildly affected (15 to 20 ppm Zn), severely affected (less than 15 ppm Zn).

The zinc level in the critically affected plants (10 to 15 ppm) is internationally recognized as low for cotton.

Maize cultivated on soils of the same type is generally zinc deficient and needs zinc supplementation to achieve maximum yield. Since cotton is only slightly less susceptible to zinc deficiency than is maize, it is not surprising that cotton on these soils occasionally shows zinc deficiency. Incidence is made more likely by removal of surface soil during grading; exposing the subsoil which has a lower content of available zinc.

Manganese Toxicity

Manganese toxicity is more widespread in N.S.W. soils than was previously thought. This year there has been definite evidence of manganese toxicity in lucerne, sub-clover, beans, lemons, and maize—in various parts of the State.

Some of this toxicity has clearly reflected acidity in the soil; some has been associated with waterlogging and reducing conditions, and some has occurred on non-acid soils under hot, dry conditions.

Methods to enable accurate and rapid determinations of manganese and aluminium of acid soils are now being sought.

Glasshouse, Pot Studies

Work previously conducted in the glasshouse at Hawkesbury Agricultural College is now proceeding at the Division of Science Services, Rydalmere. Much information is available as a result of intensive pot studies on soils from Albury, Bega, central tablelands, Taree, and other areas throughout the State. Some of the information is being processed with a view to publication.

More recently, fertility of soils from Grafton, Berry, and Barham has been studied—for effect of (presence and absence of) minor elements, inoculation, phosphate, lime, and potash on sub-clover, lucerne, and other species.

These studies have provided a valuable guide to District agronomists throughout the State on soils for which there has been very little knowledge in relation to nutrition.

Secondment of Officers to Plant Nutrition Research

Three officers, including a field assistant from Division of Plant Industry, have been seconded to the Division of Science Services for further plant nutrition research. One is continuing his programme of work on aluminium and manganese toxicity, and correction by using lime and superphosphate.

C.E.S.G. money has been allocated for a new glasshouse with some control of temperature. New methods to determine aluminium in soil and plant material will be sought for use in toxicity diagnoses.

Currently, central tableland soils are being studied in the project. A considerable expanse of tablelands country, particularly in the central tablelands, could well be included in this work.

Lime Application in Relation to Species Response

Factors in the growth of pasture, and the response to fertilizers and lime on acid soils have been studied. Important pasture species were grown on a range of soils in the glasshouse, for growth-rate responses to the soils.

Growth rates varied greatly where normally recommended fertilizer treatments had been applied. On some of the more infertile soils, lucerne and phalaris grew poorly compared with perennial ryegrass and subterranean clover.

One of the poor soils was chosen for further study. Soil samples from the field had a low soil pH (4.9 to 5.2), and the level of exchangeable aluminium was relatively high. Aluminium ions occupied between 25 and 50 per cent of the cation

exchange capacity which was between 3.0 and 5.0 mequiv./100 g soil. Calcium, magnesium, and potassium occupied most of the remaining exchange sites.

Pot experiments have shown that lucerne and phalaris growth on the Whittaker soil is restricted by aluminium toxicity at soil pH values below 5.0. Perennial ryegrass, white clover, and subterranean clover, however, were not affected by the aluminium levels present. At the field pH of 4.9 to 5.2, improvement of legume nodulation was an important effect of lime, while aluminium affected plant growth only marginally at most.

Field studies with phosphorus fertilizers demonstrated the high phosphorus-fixing capacity of the soil.

Several significant facts emerged from the study:

- (i) Susceptibility of phalaris and lucerne to aluminium toxicity. Phalaris-intolerance to aluminium is a new finding, with implications for plant breeding.
- (ii) The high need of this soil for phosphorus confirms previous suspicions.
- (iii) Lime effect in reducing phosphorus availability was not expected. It is of practical interest—as is lime's effect in reducing the availability of the soil solution cations other than calcium.

Aids for Diagnosis of Mineral Deficiencies

Diagnostic work significant for the grower and for research is continuing.

An extension article was published in the June, 1968, *Agricultural Gazette of N.S.W.* Also, a bulletin with forty colour plates has been prepared for early submission to the printery.

There has always been strong demand by farmers for aids in recognition of mineral deficiencies, and especially for pictorial aids.

In research, good correlations have been found between levels of magnesium in citrus and incidence of symptoms. As a result, previously accepted standards in relation to prediction of magnesium deficiency in citrus have been notified. This work will be extended with other elements.

Citrus Surveys

Three to five year results from the citrus surveys in the County of Cumberland, Gosford, M.I.A., and Lower Murray districts have been processed on ADP. Some of the results have now been returned to the officers concerned and are being assessed.

Herbicide Residues in Soils

A site was elected where atrazine damage was reported last season. The herbicide had severely damaged some 40 acres of onions, depressing quality and yield.

Samples of the top 4 inches of soil were taken from field areas which had received nil, low, and high herbicide treatments respectively. For comparison, "standards" containing known amounts of atrazine (0.05–10 ppm) were prepared from untreated soil. The field samples and "standards" were examined for their atrazine content by bio-assay and infra-red spectroscopy.

In a replicated glasshouse bio-assay experiment, onions were grown under favourable nutritional conditions, in the field-treated and "standard" soil samples. No effect of residual atrazine was detected on onions grown in the field-treated soils. Growth depression was visually evident in controls containing 0.1 to 0.3 ppm; 100 per cent kill of onion seedlings occurred at first-leaf stage (7 days after emergency) for treatments greater than 0.3 ppm atrazine.

Infra-red spectra of chloroform extracts of the "standards" showed the detection limit of this method to be less than 0.004 ppm atrazine in the soil. Analyses of field treatments did not detect atrazine.

From the bio-assay it appeared that less than 0.1 ppm atrazine was present in samples from the field. This is compatible with the value of less than 0.004 ppm atrazine found by chemical analysis.

On this evidence the conclusion was that if onions were grown on the sampled areas in the coming season, yield or quality decline due to atrazine residues would be most unlikely.

Analysis of Mushroom Composts

Interest in the chemical composition of mushroom composts has grown. Requests for chemical analyses of composts prepared by commercial growers have risen sharply in recent years. Analyses by Chemistry Branch rose from three in 1962 to 116 in 1968, and 73 in the first 4 months of 1969.

The aim of this service is to give growers a guide as to whether their compost formula is producing a desirable chemical composition. Analyses of large numbers from any one grower has not been possible, but advice based on selected samples has been a guide to improved methods.

Samples are tested for moisture, pH, and per cent nitrogen based on oven-dried compost. Desirable pH figures ranged from 6.8 to 7.5, moisture should be about 70 per cent, and a nitrogen figure between 2.0 and 2.4 per cent at spawning is desirable. Such a compost would contain 1.6 to 1.8 per cent nitrogen at filling. These figures are not universally accepted. Some authorities quote lower or higher optimum nitrogen percentages.

The following tabulation shows the total of samples analysed each year from 1965, and the percentage of samples in 1.51 to 2.25 per cent range for nitrogen. Only about half the samples fall within that range. This is a wide range, yet many are well outside it. Since 1967, there have in fact been a significant number of samples showing over 3.0 per cent nitrogen.

Many samples obviously would not provide optimum chemical conditions for mushroom growth and yields.

Mushroom Compost Analyses 1965-1969

Year	1965	1966	1967	1968	1969 (Jan.-June)	Total 1965-1969
Samples analysed	29	41	101	116	103	390
Percentage of samples within the range 1.51-2.25 per cent.	44.7	56.2	55.1	49.2	56.9	52.8

Use of Spent Mushroom Compost

The recent times rapid increase in commercial mushroom-growing has led to a considerable surplus of spent mushroom compost. If not merely dumped, it is used for vegetable growing and home gardens, as compost and mulch. There is at the same time a big demand for peat for use in potting mixtures, and local deposits have been opened up to meet this need formerly met by high-priced imported peat moss.

One producer has experimented with the use of spent mushroom compost as a base for potting mixtures. It usually has 1-2 per cent nitrogen and satisfactory moisture retaining properties; but usually also a pH of about 7.0—making it unsuitable for acid-loving plants such as azeleas and camellia.

Practicability of acidifying the spent compost with finely divided "flowers of sulphur" was tested. Moderate rates of aluminium sulphate had produced only a slight fall in pH (from 7.1 to 6.9) and it was feared that higher rates might be harmful to some plants.

Laboratory tests suggested that about 3 lb of sulphur per ton, if fully oxidized to sulphuric acid, should lower the pH to about 5.5. An experiment showed that 3 lb sulphur per 1,000 lb compost (i.e., over 6 lb per ton) was needed to lower the pH to the acceptable 5.5 for acid-loving plants and that this took about 6 months in warm weather. There was a tendency to rise slightly to an equilibrium pH after further storage.

Some Special Interest Diagnostic Investigation

Manganese Toxicity in Maize.—Manganese toxicity is often reported, in many crops; including lucerne, citrus, beans and a wide variety of other so-called sensitive plants.

Maize is reported in overseas literature to be relatively tolerant to manganese, and records here showed no case of manganese toxicity in this crop. However, recently, two leaf samples from a pot trial at Grafton Agricultural Research Station showed extremely high levels of manganese. Because of the symptoms (a yellowish green striping with some necrosis and chlorotic blotching of the leaves) a spray treatment for zinc deficiency was applied. The symptoms were not corrected by the spray, although the zinc level was increased from 69 to 386 ppm.

Both samples had a very high manganese level—3,860 ppm in the sprayed and 3,900 ppm in the unsprayed sample.

Nitrogen Deficiency in Avocados, and Leaf Analysis.—Pale leaf colour in avocado trees has been observed in the Murwillumbah district. Leaf samples, from a number of growers and for both Hass and Fuerte varieties, have been analysed to determine the cause.

Nitrogen levels of leaves from pale trees ranged from 0.81 to 1.55 per cent, whereas leaves from healthy trees have contained 1.55 to 2.49 per cent.

Overseas workers suggest deficiency levels range from 1.20 to 1.74 per cent, but 1.6 per cent nitrogen is most commonly quoted as the critical level. The results with the Murwillumbah leaves fit that critical order.

Supervision under the Fertilizers Act

Division of Plant Industry inspectors, under the Fertilizers Act, collect fertilizers from the various producers throughout Sydney. General speaking the nutrient content of the main fertilizers in past years has been fairly reliable. There were not very many manufacturers, and they employed chemists in sufficient numbers to supervise quality.

In the last five years the number of registered fertilizers but also of manufacturers, mixers and distributors have notably increased. Also the range and complexity of fertilizers, local and imported, have increased. The Department now finds it necessary to police the Fertilizers Act more extensively. Indeed, almost the full time of a chemist would be needed, if he were available, in part to protect grower interests and in part to assist manufacturers, mixers and producers with their formulations.

SOILS SECTION

General

The total of soil samples has reached the point where delay in reporting is deterring agronomists and the public generally from sending in samples. One effect has been a 4 per cent drop in samples received, over the last year, but the total received still represents more than "saturation" level for the available staff.

Several long-term fertilizer projects on wheat and pasture are nearing conclusion, and the next 2 years should see the publication of a substantial amount of new information on soil testing on pastures and wheat. Even so, insufficient field trials on pastures continues to hamper the development of soil tests for phosphorus and potassium on pastures. A glass-house alternative to field trials is now being sought.

Soil Testing for Phosphorus

Wheat.—Since 1965, over 6,000 analyses have been done on soils from nearly 200 fertilizer trials in the central west.

Crop response to five rates of superphosphate in all combinations with five rates of ammonium sulphate is being correlated with soil test values using eight different phosphorus tests. The aim is to predict the amount of fertilizer needed at sowing time. The computer will process the mass of data already collected.

Because climate is largely unpredictable, especially in the more western part of the central west, a probability factor (rating the individual farmer's chance of getting a profitable response from applying particular rates of superphosphate) might have to be introduced to improve the usefulness of the soil test.

Pastures.—The north coast Region supports an important store beef cattle breeding industry. Production is limited by poor quality feed from the native pastures. Nitrogen and phosphorus are the two main deficiencies in the soil. Their availability to the plant is so low that crude protein and total phosphorus contents of the plants are well below acceptable levels for satisfactory animal nutrition.

A programme of testing soils (for available phosphorus) from twenty-seven fertilizer trial sites in the mid-Clarence region is nearing completion. Over 3,000 separate soil samples have been tested over the past 3½ years, using the Bray No. 1 phosphorus test. Also, nearly 8,000 plant samples harvested from these trials await total phosphorus analysis, using the newly acquired X-ray spectrometer.

Already the work has shown that the level of available phosphorus generally in the mid-Clarence soils is one of the lowest in the State. The knowledge that phosphorus is severely limiting plant growth, and most probably animal nutrition and physiology, has had a big impact on superphosphate usage in the area.

Soil-Plant-Animal Relationships (at Shannon Vale)

In a superphosphate x stocking-rate trial on a granitic soil at Shannon Vale Nutrition Station, on the northern tablelands, pastures were topdressed at three levels of superphosphate ($\frac{1}{2}$, $1\frac{1}{2}$ and 3 cwt per acre annually) and continuously grazed at three stocking rates (4, 8 and 12 Merino wethers per acre). The trial started in 1963 and is nearing completion.

Partly because the "bank" of phosphorus at the start was already fairly high due to build-up from a previous cumulative dressing of nearly a ton of superphosphate, there has been little effect on wool production from adding further fertilizer. It is thought, however, that grazing pressure had an indirect effect on phosphorus needs.

At stocking rate of eight and twelve wethers per acre, especially the latter, young growing plants were quickly defoliated. Bulk feed available to an animal in the highest stocking rate treatment was much below that in the lowest. Perhaps because of rapid defoliation, growth is slowed down, plant vigour declines, root elongation is minimised, and thus the plant's phosphorus needs are reduced. It could be that on pastures heavily grazed but where phosphorus is not sub-optimal, there is little or no need of added phosphorus.

Soil Potassium Survey

Method Development.—Using a cation-exchange resin to estimate non-exchangeable potassium in soils has been developed sufficiently for use in routine laboratory analyses for potassium. A paper on the method has been submitted for publication.

The South Coast and Tablelands Pilot Survey.—This survey to determine potassium status of soils in the South Coast and Tablelands Region was continued. Compilation of the list of almost 3,000 properties was completed for use in it. Eighty-six properties were visited and 160 soil samples were taken during 12 weeks field work in the Region. These samples have been analysed. Thus the pilot survey is now about half-completed.

Soil Advisory Service

This year, 3,837 soil samples were received (decrease 3.9 per cent) and involved writing 754 reports (increase 11.5 per cent). Soil samples averaged 5.1 soil samples per report, as against 5.9 last year.

The work-volume is beyond the one Chemist and one Technical Officer (Scientific) employed on it. Some relief will be given by the recently created Technical Assistant/Laboratory Attendant position. The assistant will work part time on preparing the soils, but there will still be great difficulty in maintaining the service.

A major benefit from the advisory analyses is the guidance derived by District agronomists and farmers in their efforts to achieve a good fertility status of the soil before putting a crop in. One District agronomist stated this year that it was not uncommon for him to base an \$80,000 fertilizer programme for an area upon one report.

Some special projects were completed this year. One was a report to the Water Conservation and Irrigation Commission covering the fertility status of a number of sites to be irrigated from the proposed Copeton Dam. Another was concerned with growth of grass on 40 acres of reclaimed soil at the new International Airport Terminal. A third was the submission of a co-operative research paper (on the potentiometric activity of soil and plant nitrates) to "The Analyst", as mentioned earlier in this report of the Chemistry Branch.

Nitrogen Research—Central Western Wheat Soils

Twenty-one trials at Condobolin, twenty-eight at Trangie and seventeen at Cowra were sown in May/July, 1968. Soil samples were transported in drums, with dry ice for refrigeration. Analyses were made for nitrogen (as ammonium and nitrate ions) from these soils "at sowing". These values are to be statistically related to vegetative response at harvest.

Anaerobic and aerobic incubations have been completed on soils from the 1967 trials. Total nitrogen has been determined on all samples.

Seven trials at Condobolin, twenty-six at Trangie and seven at Cowra were sown in May/July, 1969. These have been sub-sampled and most of the analyses for ammonium and nitrate nitrogen completed.

Since nitrogen uptake is affected by moisture, wilting-point determinations have been made on the 1966 trial soils—using the Collis-George filter paper method.

Manganese Work

Alstonville Tropical Fruit Research Station.—In the second year of manganese toxicity trials, toxicity appeared in both the winter and spring crops of beans. In plots treated with various magnesium compounds the beans did not differ much in growth or health. The magnesium spray concentration has been reduced by half this year to avoid leaf burning.

In the chloride trial, Halo Blight occurred in the glycine section. The glycine was ploughed in and the area re-sown in October, 1968. This new glycine crop failed and was discarded in April, 1969. Only one leaf bulk-sample was collected from the glycine.

The analytical work of only two soil samplings was completed. In the second year of the correction trials, manganese concentration was very high in some plots—without considerable changes in pH values. Manganese content was high in the chloride trial in the winter crop, but there was no evidence that heavier KCL application released manganese. Sulphate of ammonia treatments (even the highest, at 8 cwt per acre) did not affect pH levels at this stage of the trial.

A report of the 3 years' manganese toxicity experiments at Terranora from 1964 to 1966 has been completed and is ready for publication.

Soil Testing for Potassium

Testing of soils from field trials around the State continued. Also, completion of the new resin technique for determination of NEAP enabled, for the first time, all samples to be tested for this fraction.

Successful negotiations were completed with Australian Fertilizers Ltd for that firm to adopt this Department's soil testing procedure for potassium.

Soil Surveys

Further work was done on the Mid Clarence Valley soil survey. The work is not yet complete. The site of the projected Orange Agricultural College has been reported on.

The report on a portion of Trangie Agricultural Research Station in relation to irrigation development is near to completion.

The Soil Surveyors attended the International Congress on Soil Science in Adelaide, and presented a paper on soil layering.

This year the first short course in air photo interpretation was established. One of the soil surveyors (Mr Riddler) had a prominent part in preparation of the course.

RICE CHEMISTRY

General

A former Departmental trainee, appointed on graduation to the vacant position of rice chemist at the laboratory of the Yanco Agricultural College and Research Station, is undergoing in-service training at Rydalmere before taking up the duties. At Yanco, besides following up the previous work there, he will do quality testing of new rice varieties in collaboration with the rice breeder.

Several new items of equipment received at the Yanco laboratory, including a Unicam spectrophotometer, will facilitate the future research.

Rice Quality

Overseas markets for rice have become more competitive. Increasing emphasis will be on quality matters. To assist the rice breeder in the selection of new and improved varieties,

several chemical tests for quality are being investigated and applied. An assistant to the rice chemist, sponsored by the M.I.A. Irrigation Research and Extension Committee, is engaged in this while in preliminary training at the Cereal Section of the Chemistry Branch and will later be located at Yanco.

Soils Advisory Samples

Some of the samples taken by Australian Fertilizers Ltd in connection with their soils advisory programme were checked at Rydalmere. The results were in general agreement with those had by Australian Fertilizers Ltd.

DAIRY CHEMISTRY

Butter and Cheese Survey

A survey of the chemical quality of butter extended from November, 1968 to May, 1969. The butters were analysed for moisture, salt and pH.

The survey of chemical quality of cheese was started in September, 1968 and is continuing. Cheeses are being analysed for fat, moisture, salt, pH and extraneous matter. Phosphates tests have been deferred.

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

Agricultural Research Institute, Wagga Wagga

WHEAT IMPROVEMENT

Yield Trials

The 1968 season featured wide yield variations, ranging from 5 to 76 bushels an acre on dryland and up to 102 bushels under irrigation. This provided much useful information on the adaptability of new material under a wide range of environmental conditions.

Of the main recommended varieties, Heron and Robin were consistently good although Robin suffered more head frosting in early sowings. In the central west Falcon was relatively better than in previous dry years. Olympic yielded well in earlier sowings in southern areas, but poorly in late southern sowings and in the central west.

The stem-rust resistant crossbred A.R. Falcon 28A yielded a little disappointingly, but overall equalled Falcon in yield and quality. It is being increased by registered growers in anticipation of naming and release.

Two other advanced crossbreds, M1224-2 and the high quality semi-dwarf M1238-2 gave variable results. They require further testing.

A harvesting Field Day was held at Coleambally. The plots were inspected and then harvested. This well attended day was a most successful way to demonstrate the yield potential of irrigated wheat.

Semi-dwarf Wheats

The semi-dwarf crossbred N.B.J. 115 referred to in earlier reports has been released under the registered name Wren. Its high yielding has been confirmed, but its milling properties have been criticized. This criticism has been associated with several varieties in southern New South Wales. Renewed efforts must be made to improve this characteristic in new crossbreds.

Semi-dwarf wheats' advantages in high yielding and irrigated areas are now well recognized. Their role in drier areas is not yet clear. Valuable information on this was had from a series of eight trials in the central west, centred in Condobolin. In the four high-rainfall sites the top five varieties were all semi-dwarf, but in the four low-rainfall sites only one, mini-Heron A, performed as well as Heron. Mini-Heron A, (2 Heron x Mexico 120) Robin, has been rejected on milling quality but is being used in further crosses.

Semi-dwarf, rust resistant Falcon lines continued to show promise and are being extensively tested.

Outstanding yield and milling quality of the red-grain Mexican semi-dwarf W.W. 15 were confirmed in trials in southern New South Wales and South Australia. It was established that a single dominant gene is controlling redness of the grain. First material from the programme for conversion to white grain has been obtained.

Research into the physiology of yield in semi-dwarf wheats has shown a negative correlation between grain and straw yields in nine varieties over five trials examined in 1968. There was a close positive correlation of varietal grain yield with harvest index (the proportion of grain in the total above-ground weight). This may be of value in plant selection work and requires further investigation.

Hard Wheats for Southern New South Wales

Difficulties in marketing soft wheats have increased the interest in hard wheats for southern areas of the State. Another factor is the general increase in soil fertility in the region, through subterranean clover, resulting in higher grain protein content. Breeding programmes will therefore be directed more towards production of hard wheats.

Soft Wheat Breeding

The soft wheat breeding programme is continuing, aimed at developing varieties suited to irrigation—with emphasis on stem rust resistance and biscuit quality.

Wheat Cytogenetics

This research is aimed essentially at transferring useful characters for wheat improvement from certain grass species closely related to wheat and which can be crossed with wheat. For the past year it has proceeded along the following lines:

Monosomics.—Cytogenetics wheat breeding exploits the use of monosomic lines of wheat; lines deficient in turn for one chromosome of the twenty-one pairs. Verification of the monosomic lines in the varieties Heron and Falcon has been pursued in crosses of each line with the corresponding Chinese Spring ditelosomic. These two monosomic sets will form the basis of the wheat cytogenetic breeding programme at Wagga.

Chromosome Additions.—Through a combination of crossing and cytological techniques, individual chromosomes of relatives of wheat can be added to those of the wheat complement. This is the first step in a method of transferring useful characters. Of particular interest in this work is the possible transference of take-all (*Ophiobolus graminis*) resistance from a related species to wheat.

Wheat-rye Addition Lines.—Growth and developmental characters of the chromosome addition lines of rye (*Secale cereale*) to wheat (Heron) have been studied. Further chromosome misdivision lines have been assembled, towards building a complete set of ditelocentrics of the seven rye chromosomes.

Wheat-Agropyron Addition Lines.—Crosses of Wren, Robin, and Olympic A103 to an amphidiploid of (Heron x *Agropyron elongatum*) have been made to obtain addition lines for certain *Agropyron* chromosomes in backgrounds of local wheats.

Triticales.—Triticale, the hybrid between wheat and cereal rye, has a possible place in agriculture as a grazing-feed grain cereal. Research in this field at the Institute has been stimulated by overseas reports of high yields of new forms of *Triticale*.

This work has been followed along two lines: (i) introduction and multiplication of *Triticales* from overseas, including both octoploid and hexaploid types; (ii) production of hexaploid *Triticales*. A few crosses have been achieved between certain rye species (*S. cereale*, *S. vavilovii*) and *Triticum durum* of a semi-dwarf type.

Monosomic Analysis.—Techniques of cytogenetics, one of them monosomic analysis, are valuable for ascertaining the genetics and breeding behaviour of characters of wheat. Monosomic analysis of genic male sterility in wheat has been started; also monosomic analysis of grain hardness. These studies might give wheat breeders a fuller understanding of these characters.

Nullisomic—5B Studies.—This is a revolutionary breeding technique enabling new characters to be bred into wheat from many of its new relatives. Numerous crosses have been made between monosomic 5B of wheat and a range of *Aegilops* species, to investigate and use homoeologous recombination in local wheat breeding programmes.

Wheat Quality Investigations

The micro milling and baking technique, introduced last year for screening the quality of plant breeders' early generation wheats, has been used extensively as a routine quality-prediction test. Results have provided the basis for very effective screening and, in some cases, rejection of a high proportion of lines.

An associated grain hardness test has usefully detected somewhat softer types amongst high baking-quality lines. Such wheats could be more readily accepted by industry.

Although there is little difficulty in detecting extremes in millability, fine differentiation of milling quality is not yet possible during micro milling. This is receiving attention. Precision might improve after further experience with the techniques.

An apparent anomaly met during the measurement of gluten maturity by one particular physical dough-testing method has been further studied. A fundamental difference in behaviour, depending upon whether the flour maturity is achieved by natural ageing or by artificial oxidation, has been shown.

The Brabender Extensograph has been shown by research over recent years to be particularly sensitive to variations in flour maturity. However, its use as a routine method to detect overstability in early generation crossbreds was not possible, because of the large quantity of flour needed for each test.

Using some of the techniques developed for micro-baking and a slight modification of the Extensograph, a micro test using very small quantities of flour or finely-ground wheat has been devised. Early comparative trials have shown close agreement between results from the micro and normal methods. The micro test is now being used on flour residues from this year's micro-baking to check its feasibility as an alternative to the currently subjective assessment of maturity during test baking.

OAT IMPROVEMENT

Variety Trials

The 1968 season was reasonably good for yield testing in all types of trials. Disappointingly, the early-sown grazing trial could not be sown earlier than 1st April, but rainfall thereafter was enough for good initial growth and adequate recovery.

Sowing of the grain oat variety trials also had to be delayed up to mid-June, because of too wet conditions. For this reason, yield results for the ungrazed were below those obtained in recovery after two or three grazings to ground level by sheep.

A moisture stress prior to ripening affected in particular the grain recovery yields of the early-maturing varieties after heavy grazing. Thus Cooba and Fulghum yielded considerably below expectation. This dry spell also reduced bushel weights significantly; 40 lb per bushel was rare, and some were as low as 33 lb per bushel.

Cooba was again the most prolific green forage producer. Results to hand from the 1969 season also indicate no new crossbred likely to surpass this variety as a dual-purpose oat for early sowing and heavy grazing.

In the mid-April sown trial with two grazings Coolabah was again the leading variety, for green fodder production and grain recovery overall. It was significantly superior to all but Fulghum in grazing yield and to all but Avon x Osage and Bundy in grain recovery. No new crossbred yet available compares favourably with Coolabah in this type of oatgrowing.

The new crossbred Avon x W4464 performed second best in grain yield in the ungrazed, grain-yield trial, but its grain quality is intermediate to its parents'. Therefore, it has limited prospects. Its green fodder production was extremely poor, providing only about half the bulk of leading dual-purpose oats, but its grain recovery was excellent.

Excellent grain yield performance of Avon x Osage was the highlight of the 1968 season. In the late-sown grain oat variety trial it significantly outyielded every recommended variety except Coolabah. It was also significantly superior to all other commercially grown oat varieties in grain recovery after heavy grazing, and second only to Coolabah in grain recovery after more lenient grazing.

Avon x Osage has better milling quality than Avon. Its husk percentage was 29.0, as compared with 31.7 for Avon in the mean of the last 5 years. Its bushel weight was generally 1 lb heavier than Avon. It was also less "itchy" during harvesting operations.

In green fodder production it was generally equal to Avon; had a slower early growth, but a better recovery because it was less susceptible to grazing damage.

From the review of all results from all testing centres since 1964, Avon x Osage is seen as a suitable replacement of Avon. Therefore, an application for naming this crossbred is proposed. Stocks of pure seed were supplied to Registered Seed Growers this season.

Nitrogen Application and Seed Rate Trials

In a combined nitrogen and seed rate trial with two varieties at Temora in 1968, with the pasture research officer, nitrogen applications of 20, 40, 80, and 120 lb per acre were compared with the nil treatment. Three seeding rates of 60, 90, and 120 lb per acre were used.

The highest seed rate (120 lb per acre) resulted in an increase of fodder production of 23 per cent at the nil treatment in the mean of both varieties, as compared to the 60 lb per acre seed rate. The combination of highest seed rate with various nitrogen applications resulted in a steep rise between 31 and 56 per cent. Also, there was a 3 bushel per acre benefit in grain recovery after heavy grazing, in the mean of all treatments with the highest seed rate. Coolabah showed a better response to nitrogen application than Cooba.

Another nitrogen x variety trial was at Henty. Cooba, Coolabah, Fulghum, and Bundy were the varieties. All were at the 60 lb per acre seed rate. In green fodder production the response to the first 60 lb of nitrogen, averaged over the varieties, was significant. Response to the second 20 lb of nitrogen was not. There was no significant difference in the grain recovery yields.

Fulghum showed the best response to nitrogen application followed by Bundy. However, the actual green fodder yields were still below those of Cooba at the same levels of nitrogen application.

New Method of Selection for Frost Resistance

A new method of breeding for frost resistance was developed by using a lawnmower prior to anticipated frosty spells on the drill-sown F_2 material.

The susceptible Avon check rows almost entirely were killed by this treatment, while the frost resistant Fultex check showed no loss. The selected surviving F_2 single plants should not only provide promising material in breeding for frost resistance, but also show good resistance to grazing injury. This most severe "grazing" test would kill all plants with rapid or even intermediate stem elongation.

The same method will be used on the selected frost-resistant material sown in F_3 short rows in the 1969 season.

WEED INVESTIGATIONS

Skeleton Weed (*Chondrilla juncea*)

Cultivation to 25 cm, and preplanting weed control with chemicals, reduced skeleton weed populations. This also increased soil mineral nitrogen and soil water content at sowing, as compared with the commercial wheat production methods of shallow cultivation and post-emergence weed control.

Preplanting weed control with picloram 8 oz a.i. 12 months before sowing, and with 2,4-D 16 oz a.i. one month before sowing increased grain yield significantly. Preplanting weed control with picloram 2 oz a.i. applied one month before sowing reduced grain yield.

Herbicide translocation studies in skeleton weed were commenced. The herbicides 2,4-D, picloram, dicamba, tricamba, and azulam, were applied at field application rates, to 5-months old skeleton weed plants so that none came in contact with the growth medium. Only picloram treated plants showed damage to the full root depth (80 cm) and to the major branch roots. However, an apparent regrowth stimulation approaching significance, at the 50-60 cm depth in 2,4-D treated plants suggests deeper penetration of this herbicide than field observations indicate. A comparison of responses of first and second year plants appears necessary if behaviour in the field is to be understood.

Weed Control in Wheat

In post-emergence trials for control of skeleton weed, picloram, picloram/2,4-D, and picloram/MCPA mixtures applied at 0.25, 0.375, and 0.75 oz a.i. picloram per acre, controlled the weed satisfactorily at all times and each rate of application. Grain yield was reduced as the time of application was delayed beyond the 4-leaf stage, was increased with an application rate of 0.25 oz picloram and decreased with 0.75 oz picloram.

In the post-emergence trials for control of *Amsinckia* sp., *Papaver* sp., *Fumaria* sp. *Polygonum aviculare*, *Lolium rigidum*, and *Vulpia bromoides*, substituted urea/benzonitrile mixtures gave satisfactory weed control at each rate. With application rates of 1 and 2 oz bromoxynil per acre, increasing the substituted urea from 0 to 4 oz a.i. increased grain yield significantly. However, with bromoxynil at 4 oz a.i. per acre each increment of the substituted urea reduced yields.

Weeds in Wheat; Effect Survey

The second survey of the general effect of weeds on wheat production was completed in 1968-69. As in the previous year, weeds amounted to almost one-fifth (19.4 per cent) of the total dry matter produced in representative crops up to flowering time.

Annual grasses were clearly the most conspicuous weeds over all. But skeleton weed, annual clovers, capeweed and black oats were also widely spread. The weeds reduced wheat yields by 17.7 per cent, on average.

A third and final survey was commenced in May, 1969.

PLANT PATHOLOGY

Systemic Fungicides re Cereal Diseases

Loose Smut of Wheat and Barley.—Availability now of highly promising systemic fungicides has led to considerable testing of their efficiency as seed dressings to control wheat and barley loose smut.

In Wagga, Condobolin and Temora trials the oxathiin fungicide vitavax at 2.4 and 1.2 oz per bushel gave almost complete control of commercial levels of smut in three wheat varieties and one barley. Control even at 0.4 per bushel was very useful. As a result, all foundation seed of Heron and Robin supplied this year by the Department to Registered Seed Growers has been treated with vitavax at 1 oz per bushel.

The effect of one year's storing of seed treated with vitavax and vitavax plus ceresan was investigated by comparing it with freshly dusted seed. Germination and yield were not suppressed, and fungicidal activity was not affected. However, the previous season's observation that addition of ceresan to vitavax reduces its efficiency against loose smut was confirmed.

In a screening trial benomyl (benlate) gave excellent control of loose smut of wheat. It was inferior to vitavax against loose smut of barley but gave very useful control.

Work to determine the range of spread of wheat loose smut from an infection focus in a non-smutted crop has been initiated.

Flag Smut of Wheat.—At 2.4 and 1.2 oz per bushel, vitavax gave very promising control of both seed- and soil-borne flag smut.

Bunt of Wheat.—Several chemicals gave good control at one-tenth of the maximum spore load per seed. However, most of the compounds, promising in the previous season, including vitavax and benomyl, were disappointing. This supports earlier evidence that environmental conditions affect the fungicidal action of seed dressings.

In the 1968-69 season there were relatively many bunted crops in N.S.W. Several were very heavily infected. Some were grown from seed treated with hexachlorobenzene. The bunt was not the hexachlorobenzene-resistant race of *Tilletia foetida* present in Victoria, but *in vitro* tests indicated ability of the spores to overcome the chemical's toxic action—at least under certain as yet undefined environmental conditions.

PLANT PHYSIOLOGY

Water-use Efficiency in Wheat Production

The study of relationship between wheat plant water economy and grain production is continuing. Unfortunately a period of severe wind gusts towards the end of the last

season caused so much damage to some of the experimental plants that a firm conclusion has not been possible. But the relationship between developmental pattern of the plant, its water use and its yield was usefully indicated. The work is being repeated with added precautions against damage.

Funds have now enabled two lysimeters to be installed in a field crop, for a detailed record of water loss from crops undergoing different treatments under virtually natural conditions. Thus the basis for a detailed analysis of the onset and development of water stresses is provided.

The lysimeters are to be operated in close association with the crop-climate studies undertaken in the Institute's Crop Agronomy programme, co-operatively with specialists from the Macquarie University. This should ensure highly beneficial association of the physiological study of the wheat plant and the agronomic study of the crop.

Reliable information on the relationship between actual and potential evapotranspiration and how this is affected by leaf area index, planting density, irrigation and climatic conditions is anticipated. The project will proceed for at least 3 years.

PASTURE INVESTIGATIONS

Stocking Rates/Superphosphate Rates Trial

In the Wagga region the most common rotation practice is 4 years subterranean clover and Wimmera ryegrass pasture followed by two or three cereal crops. Pastures are top-dressed each year with 90-100 lb superphosphate per acre. The district carrying capacity is less than two dry sheep equivalents per acre.

A grazing trial at the Institute on moderately low phosphate-status soil has indicated that the stocking rate can be raised to six dry sheep per acre, although some maintenance feeding is needed for three weeks in about one autumn in two. Superphosphate did not increase wool production per acre and, with an increase in stocking rate of one dry sheep, greasy wool production dropped by $\frac{1}{2}$ lb per head.

Because of the implications, the trials are to be extended in the region. Four sites have been selected on private properties within a 70-mile radius of Wagga Wagga. They are based on subterranean clover pastures sown on red-brown earths. Two are in the 18 and two in the 22 inch rainfall zone. In each zone, one site is on a soil of medium phosphorus status and the other on soil of high phosphorus status.

The sites have been stocked with Merino ewes, autumn mated to Border Leicester rams and are receiving treatments of 0, 1 and 2 cwt of phosphate per year. Stocking rates in the 18 inch rainfall zone are 1½ and 3 ewes per acre, increasing to two and four ewes per acre in the 22 inch rainfall zone.

Management: Time of Lambing Trial

To provide information on the biologically and economically most suitable time of lambing, a trial comprising two stocking rates (three and five crossbred breeding ewes per acre), two lambing times (autumn and spring), and four management systems (involving autumn deferment and supplementary pastures of oats and lucerne) has been started.

The oats and lucerne are primarily to top off the lambs and comprise 50 per cent of the area. While lamb needs are being met adequately, ewes may also graze these areas. The trial is based on a subterranean clover and Wimmera ryegrass pasture and is topdressed annually in the autumn with 1 cwt of superphosphate per acre.

The first lambing in spring of 1968 indicated some interesting trends. For example, treatment without supplements produced more mutton per acre than did those with supplementary areas but the stress on unsupplemented areas to achieve this has left those areas unable to make enough growth at the seedling stage to keep production ahead of demand. This trend was not evident at the next lambing (winter, 1969), wherein all treatments have abundant feed so far.

After a good harvest of oat grain in November, 1968, supplementary feeding with grain was not needed over the summer. There were bounteous late summer rains.

The spring lambing group have been successfully joined for the second time.

DRY LAND LUCERNE

In the Wagga region lucerne has been mainly on creek and river flats. On higher country it has a reputation for poor persistence, probably associated with poor management of the lucerne stands.

A trial is now being conducted. This is to examine two management systems (three paddocks and nine paddocks) at two levels of stocking (four and six sheep per acre), using breeding Merino ewes and spring lambing. Production at the lower stocking rate is being compared with production at the same stocking rate on a wholly annual pasture.

During the very dry, late spring in 1967, the density of lucerne plots was reduced by 35 per cent. A late break in the 1968 autumn provided a substantial flush of grass following the drought. Sheep were returned to the plots when adequate feed was available. Very little lucerne came away and the grass dominant pastures provided ample feed of good quality until summer. Then severe grass seed production in all plots caused bodyweight losses. Weight changes attributable to treatments were not discernible at this stage.

Good late summer rains in 1969 again supplied ample feed, this time as fully recovered lucerne stands. But, again, treatment differences were not discernible—since no system was being fully utilized.

Mating has now been completed but, in mid-winter, pastures are still well ahead of demand—at all stocking rates.

Perennial vs Annual Grasses, in the Wheat Belt

Little information is available on the relative performance of perennial versus annual grasses in the wheat belt. A trial has been established to compare annual production data at two stocking rates; on phalaris plus lucerne, lucerne alone, subterranean clover plus phalaris, and subterranean clover plus Wimmera ryegrass pastures. Grazing will start in winter 1969.

Cereals for Winter Fodder

Pilot work in 1967 has been followed by a trial to determine the relative performance of several cereals in producing winter feed; measured by dry matter cuts and their ability to recover and produce grain. Wheat, oats, barley and cereal rye are being compared; with two different timing systems for grazing.

CROP AGRONOMY

Fallowing and Wheat Production

Two of the 1967–68 experimental sites were harvested in December, 1968. The other site was not sown, due to waterlogged conditions.

As in the preceding year, there was no difference in moisture conservation due to time or method of fallowing. But there was the expected increase in plant-available nitrogen under the long fallow conditions.

At the drier site (16 inch annual rainfall) there was a small increase in yield due to long fallow. This was accompanied by marked time-of-sowing effects. The May sowing yielded 33.3 bushels per acre, with 11.4 per cent protein; compared with 17.7 bushels per acre, and 14.0 per cent protein, for the later sowing.

At the other effective site, located in a slightly higher rainfall area (18 inch rainfall), there was no apparent effect due to fallowing methods nor to time-of-sowing. The latter appeared to reflect the heavy weed growth on the early sown plots. Protein level was 12.5 per cent on the early and 15.3 per cent on the late sown plots.

A further series of trials was started in 1968 and sown in May and June, 1969. Soil moisture measurements in early May indicated no difference between spring and autumn fallows prepared by mechanical means. However, the use of herbicides in the autumn to control pasture growth resulted in less stored moisture in the soil profile, compared with the conventional fallow methods.

Fertilizer Agronomy

A late break in the weather delayed land preparation. This in some cases resulted in poor weed control. A period of wet weather late in May interfered with sowing and had an effect on trials established in June. Early sowings got off to

a good start but some of the later sowings were adversely affected by weeds and waterlogging. Subsequent seasonal conditions were favourable and good yields were recorded in the majority of trials.

Nitrogen and Phosphate Trials.—Fourteen field trials were established to meet the needs of:

- continuous calibration of laboratory techniques of soil phosphorus determination, for estimation of optimum fertilizer application on wheat crops;
- research into the practicability of a soil test for nitrogen fertilizer recommendations;
- agronomic investigations on the behaviour of phosphorus and nitrogen fertilizers on wheat.

Trial designs were 5 x 5 factorials with two replicates using superphosphate (22 per cent) drilled with the seed at 0, 50, 100, 200 and 400 lb per acre, and urea topdressed at sowing at 0, 20, 30, 40 and 60 lb N per acre. Plot size was 1/100 acre. The wheat variety was Heron. Soil samples were collected before sowing, for N and P determination. One trial was abandoned because of weeds. From the thirteen trials harvested the responses to treatments were as follows:

	P	N
Significant increase in grain yield	11	2
Significant depression in grain yield	—	5
No significant variation	2	6

Forms and Methods of Nitrogen Application on Wheat.—Three trials were established to investigate the effects on wheat of three forms of nitrogen, applied broadcast or drilled. Sulphate of ammonia, urea and ammonium nitrate were applied at sowing, at rates of 0, 20, 30 and 40 lb per acre. Superphosphate (22 per cent) at 100 lb per acre was drilled with the seed (Heron) on all plots. One trial was abandoned because of weeds.

Observations included plant counts after emergence, dry matter production at flowering, and grain yield at harvest. Final computer analysis of results is awaited but preliminary examination indicated only small differences between treatments and no particular advantage from either method of application or from form of nitrogen.

Proprietary Phosphatic Fertilizers Compared.—Three trials were established to compare the effects of six proprietary brands of phosphatic fertilizer on wheat: 22 per cent superphosphate; 45 per cent hyfos; 12:52:0; 18:46:0; 15:30:0; and 18:18:0.

The fertilizers were drilled with the seed at rates of 18, 27 and 36 lb P_2O_5 per acre. Observations included plant counts after emergence, dry matter production and grain yield.

Final computer analysis of results is awaited but preliminary examination indicated no effect due to treatment on emergence. Phosphorus, irrespective of form, increased dry matter production. Grain yield variations due to treatment indicated 22 per cent superphosphate to be at least the equal of if not superior to any of the other forms of phosphate.

Trials for the 1969–70 Season.—Sowing of nineteen trials has been completed. Fifteen of the trials are using nitrogen and phosphate for calibration of laboratory analysis of soil phosphate tests for investigations into soil nitrogen tests and agronomic investigations into the behaviour of N and P fertilizers on wheat. Two trials are to evaluate proprietary brands of phosphatic fertilizer, and two to investigate the behaviour of three forms of nitrogen supplied by two methods.

Wheat, Continuous Cropping Project

There is a need to understand more closely the consequences of the recent intensification of cropping in the southern wheat belt and, on the other hand, to investigate possible methods of reducing production costs—especially if those methods lead to increased flexibility. Little is known of the long term implications of chemical weed-control, use of nitrogen fertilizers and of some modern minimum tillage practices.

This project is an attempt to extend several aspects of current work at the Institute in these fields. Essentially it is comparing wheat establishment methods, having regard to maintenance of soil fertility and physical condition in relation to crop yields.

Five trials have been laid down in clover-improved paddocks in the southern region, after a protracted search for suitable sites to include a fair range of soil types and climatic conditions. The sites were soil sampled for fertilizer requirements. Twelve treatments were imposed in a randomised

block design of five replicates. The project will be in the same form and at the same locations for several years. Sowing was completed by the end of June, 1969.

SOIL CHEMISTRY

Soil Phosphorus

Results of the fifty-four wheat fertilizer trials in the years 1964-66 were subject of further statistical analyses this year.

The general relationship between increase in wheat yield and superphosphate applied was: $Y = 8.87924 S^{\frac{1}{2}} - 2.30489 S$ where no nitrogen had been applied, and $Y = 10.15810 S^{\frac{1}{2}} - 3.03114 S$ where nitrogen had been applied at the rate of 40 lb N per acre (where Y = yield increase in bushels per acre, and S = single superphosphate applied in 100 lb/acre).

Relationships were established between yield increase, superphosphate applied, "available" phosphate in the soil, pH, and the expected annual rainfall.

Tables for each rainfall zone and pH class were generated by computer, so that for any available phosphate value a recommendation of the best rate of superphosphate to apply can be calculated. Recommendations obtained in this way were used in the Pilot Soil Testing Service.

Pilot Soil Testing Service.—Details for the running of the Pilot Service were devised in consultation with extension officers of the Southern and South Western Regions. The Service was launched in December, 1968, with the collaboration of the Publicity Officers of the Southern and South Western Regions.

Near to 200 farmers, in thirteen shires, applied to join the service. Their paddocks were then sampled during the months up to sowing time, by field assistants attached to three centres in the Southern Region and one in the South Western Region and by field assistants from the Agricultural Research Institute, Wagga.

Soil samples were prepared at the Institute for analysis, and "available" phosphate was determined. Recommendations as to superphosphate rate were calculated from these values and sent to the farmers via the District agronomists; with a request for the sowing of test strips at rates above and below the recommended rate. This request was made of farmers because the objective of the Pilot Service in the 3 years of its existence is to test whether the calculated recommendations are accurate and reliable.

A field officer has been seconded to the Pilot Service from the Division of Plant Industry, to assist in the evaluation of the accuracy of the soil test recommendations. He visited most of the participating properties prior to sowing, and will visit all farmers during winter and spring to discuss arrangements for the harvesting of the strips.

Statistics of the current year's Service are as follows:

Centre	Leeton	Wagga	Cootamundra	Albury
Farmers	14	58	58	58
Paddocks	29	58	67	58
Soil samples	75	107	111	91

Nitrogen Soil Tests

Feasibility of using a suitable measurement of plant available nitrogen to predict the nitrogen fertilizer requirement of southern New South Wales wheat soils continued to be studied.

A glasshouse evaluation of a series of chemical and biological (incubation) methods of determining available soil nitrogen has been completed. The test crop was perennial ryegrass (*Lolium perenne*) grown in twelve contrasting soils, treated with several rates of nitrate fertilizer. The strategy used was to establish first a relationship between applied fertilizer and plant response, and then to relate the parameters describing these relationships with the various soil nitrogen indices.

Generally, it was found that soil nitrogen indices which measured total mineral-nitrogen at planting or included this value with an estimate of the potentially available organic nitrogen gave the better correlations. Incubation-nitrogen

values gave weaker correlations. The best index of available soil nitrogen was based on a multiple regression involving total mineral-nitrogen and alkali-permanganate soluble-nitrogen.

A preliminary field evaluation of the same soil tests indicated that the tests successful in the glasshouse experiment were generally the better tests under the particular experimental conditions. The results indicated the advantage of measuring not only the immediately available nitrogen but also the subsoil nitrate-nitrogen concentration and some measure of the organic nitrogen that may be mineralized during the growing season.

The investigations of these methods as possible soil nitrogen tests are being continued in a further two field programmes. Wheat yields are being collected from a series of nitrogen and phosphorus fertilizer trials located in the region over a number of seasons. The available nitrogen in soil samples (0-10 cm, 10-30 cm depth) collected from the experimental sites is being related to grain yield and yield increase by regression analysis.

Also, the determination of critical levels of available soil nitrogen below which wheat will respond to nitrogen fertilizer has continued. During 1968, wheat grain yield responses to 30 lb per acre of ammonium nitrate, broadcast shortly after sowing time, were measured at 239 sites in the southern wheat belt. In the western half of the wheat belt, typical effect of the added fertilizer was to depress yield. But in the eastern half a general increase in yields was observed. In both parts of the wheat belt, responses to nitrogen were correlated with measurable nitrogen status of site. This status appeared to be most efficiently gauged using a combination of two soil tests. This was also the case in 1967-68.

Using two of the better tests to classify sites, distinctive patterns of response were apparent. In the west, nitrogen fertilizer decreased yields by 0.8 b.p.a. at the low nitrogen sites, but by 2.3 b.p.a. at the high nitrogen sites. In the east, fertilizer increased yields by 7.5 b.p.a. at the low nitrogen sites and by 2.9 b.p.a. at the high nitrogen sites.

During the latter part of 1968-69, 225 experiments were located in 300 of the paddocks selected and tested for a third year of this programme. It is not yet known whether a further year's effort will be needed to achieve fully the objectives of determining where nitrogen fertilizers should be used in the southern wheat belt.

Fertilizer Nitrogen Reactions in Soils

Under dryland agriculture, losses in excess of 50 per cent applied nitrogen fertilizer have been recorded. These may be due to various chemical and biological reactions of the fertilizer with the soil resulting in volatilization losses of ammonia, denitrification, biological or chemical fixation in the soil or leaching losses.

Because of the increased availability of Australian produced nitrogen fertilizer (estimated at 495,000 tons per year by 1970), a study of the reactions and availability of various forms of nitrogen fertilizer in southern New South Wales wheat belt soils has been started.

In a pot trial using varying sources of nitrogen fertilizer (ammonium sulphate, sodium nitrate and urea) and six representative soils from the southern wheat belt, there was a significant interaction between fertilizer form and soil type as represented by the yield of the test plant (perennial ryegrass). The soils varied in size nature, from a red sandy loam to a black self-mulching clay.

Non-exchangeable Ammonium.—The possibility that some of the fertilizer has become unavailable to the plant in the form of "non-exchangeable" or "fixed" ammonium is being investigated. The normal method of determining this fraction of soil nitrogen is to use a destructive hydrofluoric-hydrochloric acid digestion. But the method has not been satisfactory in extracting this fraction from the soils studied. Laboratory investigation of this problem is continuing.

Volatilization Losses of Ammonia.—Losses of fertilizer nitrogen as ammonia gas from ammonium nitrate and urea topdressed on a grazing cereal crop are now being studied. Preliminary results confirm that significant losses, particularly of urea, can occur when the fertilizer is surface-applied.

Leaching Losses of Nitrogen.—Laboratory methods to follow the movement of nitrogen fertilizer through soils are under examination.

Agricultural Research Directorate, Tamworth Station

PASTURE SPECIES NUTRITION

Lucerne: Phosphorus/Sulphur Nutrition

Nutrient Concentration in Lucerne Tops.—The relation between nutrient concentration in the lucerne tops and nutrient status are subject of correlation and regression studies. The following tentative conclusions are: (i) Sulphur concentration of lucerne tops is more closely related to nutrient status than is phosphorus concentration; (ii) Marginal zone for sulphur concentration in lucerne tops is 0.14 to 0.20 per cent oven dry material; (iii) Marginal zone for phosphorus concentration is 0.12 to 0.20 per cent oven dry material; (iv) The middle and lower leaves are the plant tissues in which the sulphur concentration is most closely related to the sulphur status of lucerne.

Nutrient Needs of Lucerne in the Field.—The four field experiments on Research Station soils were harvested four, or five, times this season. At the first two harvests highly significant yield responses to phosphorus were recorded on every soil. Responses tended to become insignificant at later harvests, due to increased variability during summer droughts. Maximum or near maximum responses generally occurred at a phosphorus rate equivalent to 3 cwt superphosphate/acre. There were no responses to sulphur. Sulphur tended to depress rather than increase yields. Results suggest that Station soils are not deficient in sulphur for lucerne and that concentrated superphosphate containing as low as 5 per cent sulphur could be used.

White Clover: Phosphorus/Sulphur Nutrition on Granite Soils

Experiments in this series have been in progress for 3, 2 or 1 years; each set will be sampled for five seasons. Thus the experiments established earliest will end after another two seasons. In the last two summers plant mortality has been high, due to drought, and white clover is proving unsuitable as a perennial legume under these conditions. A large volume of data, including dry matter and protein yields, and nitrogen, phosphorus, and sulphur concentrations of the plant material, is now available. These data are being processed. Meanwhile the preliminary conclusions are:

(a) **Initial Phosphorus and Sulphur Needs.**—Maximum or near maximum responses in both dry matter and protein generally occurred at a phosphorus rate equivalent to 4 cwt superphosphate/acre but the maximum economic responses probably occurred at a rate closer to 2 cwt/acre. Maximum responses to sulphur normally occurred at 25 lb/acre. These results indicate that the optimum rate of superphosphate would be in the range 2–4 cwt/acre. At the correct rates of phosphorus, concentrated superphosphate would not contain sufficient sulphur; while sulphur fortified superphosphate would contain far too much sulphur.

(b) **Long Term Phosphorus and Sulphur Needs.**—Although there were very large residual responses to phosphorus applied in the first year, particularly at the higher rates, there were very significant responses to phosphorus applied in the second year—regardless of the initial rate of application. Where superphosphate had been applied in the first year at rates of 4 cwt/acre or more, superphosphate at 1 cwt/acre in the second year was enough to maintain maximum yields. There was little if any residual effect of sulphur applied in the first year (as fine gypsum). Sulphur at 25 lb/acre was needed every year to maintain maximum yields.

WHEAT NUTRITION

Wheat: Sulphur Nutrition

(a) **Sulphur Nutrition in Relation to Agronomic Factors.**—Two more field experiments were done on sites known to be sulphur deficient for lucerne. One experiment on a high phosphorus soil aimed at determining the effect of nitrogen nutrition on responses to sulphur. The other aimed at determining the effect of nitrogen and phosphorus nutrition and length of growing season on responses to sulphur. Moisture conditions were very good except towards the end of the season (October).

On the high phosphorus soil there was no response to sulphur, either vegetative or in grain yield. Nitrogen caused an increase in vegetative yield from 8,170 lb to 9,210 lb/acre (sampled in boot stage), but a significant decrease in grain yield from 46.2 to 36.7 bushel/acre. The sulphur concentration of the wheat tops was quite high (greater than 0.20 per

cent) and appeared unrelated to rates of applied sulphur, but concentration in the wheat grain tended to increase with increasing rates of sulphur.

On the low phosphorus soil, Winglen—in the dry matter yield of tops—showed a response to sulphur in the presence of high nitrogen and phosphorus when sampled in late July, but there was no other response to sulphur by either Winglen or Festiguay when sampled at other times (early November and harvest). There was also a response to phosphorus in the winter growth of Winglen. The nitrogen responses by both varieties at all harvests were very significant.

Thus in two contrasting growing seasons, under a variety of agronomic conditions, wheat has failed to respond to sulphur on soils known to be sulphur deficient.

Therefore it may be concluded that wheat is insensitive to present levels of sulphur deficiency, and that it is quite safe to use concentrated superphosphates on northern wheat belt soils.

(b) **Sulphur Nutrition of Wheat, Compared with Other Species.**—In an attempt to clarify the reasons for apparent insensitivity of wheat to sulphur deficiency, a glasshouse experiment was done. This was to compare wheat's sulphur need with that of oats, lucerne, and white clover. Plants were harvested twice; the cereals at flowering and maturity, and the legumes at early flowering.

At first harvest all species except clover gave significant responses to sulphur; sensitivity to sulphur deficiency in decreasing order of magnitude being lucerne, wheat, oats, and clover. All species responded to nitrogen. Wheat and oats were the most responsive.

At the second harvest there were very large responses to sulphur by all species, but only lucerne and clover responded in the absence of applied nitrogen. In the presence of applied nitrogen wheat was the most sensitive to sulphur deficiency; followed by oats, lucerne, and clover. Wheat gave an elevenfold increase in yield of tops with applied sulphur.

These results indicate that under the same conditions, wheat and oats are actually more sensitive than lucerne and clover to sulphur deficiency. However, chemical analysis of material must be done before the gross uptake of sulphur by each species is known. It appears that lack of sensitivity of wheat to sulphur deficiency under field conditions must be due to an agronomic factor, such as fallowing.

Wheat: Nitrogen Nutrition After Lucerne Leys

Better moisture conditions resulted in higher yields, of both wheat and lucerne, from the long-term experiments on the Research Station. Growth and yields of wheat on the continuous-wheat treatments (third year of cropping) were obviously affected by nitrogen deficiency, particularly on the black earth. Yields from the wheat/cowpea rotation plots were considerably higher than from continuous-wheat, but this may have been due partly to better moisture accumulation on these plots.

Again there were much lower levels of soil moisture under lucerne than under the other treatments.

Soil moisture was 27 per cent at 20–30 cm depth in the red brown earth (6.2.69–20.2.69) under the continuous fallow and wheat treatments, and only 20 per cent under lucerne. There were similar levels of soil moisture at the 190–200 cm depth, except that it was much higher (25 per cent) under the 8 months old lucerne.

In the black earth there were much bigger differences between treatments at the 20–30 cm depth: 36 per cent under fallow, and 21–23 per cent under lucerne. At the 190–200 cm depth there was 29 per cent moisture under fallow, and 20–21 per cent under the 2 and 3 year lucerne stands.

The four off-station experiments all failed to show any increase in either vegetative growth or grain yield from the application of fertilizer nitrogen. One of these experiments, in its second year after lucerne, actually showed a significant depression in grain yield. Grain protein analyses are not yet complete, but at least one experiment showed a significant increase from 13.9 per cent to 15.9 per cent as a result of nitrogen application.

Wheat: Phosphorus Nutrition re Soil Testing

(a) **Soil Test Methods.**—All soil samples from wheat fertilizer experiments done in the period 1962 to 1964 were analysed for phosphorus by the Bray No. 1 and Bray No. 2 methods. A preliminary examination of the results indicates that these analyses do not give a better indication of phosphate needs than does the sodium bicarbonate method.

(b) *Soil Test Calibrations*.—An assessment of data from the 1962 to 1964 wheat fertilizer experiments led to the development of a calibration which has been appropriately recorded. It could form the basis of any phosphate advisory service in the northern wheat belt.

"THE AUSTRALIAN WHEAT COLLECTION"

Re-naming; Accommodation; Organizing

The "National Wheat Variety Collection" was renamed "The Australian Wheat Collection", the latter being simpler and more appropriate.

The building to house the Collection was completed late in 1968 and immediately occupied by the Curator who was appointed in August, 1968. A field assistant and a shorthand-writer/typist were appointed during the first half of 1969.

Initial troubles with plant maintaining the storage and preparation rooms at the low temperatures and low humidity needed for long term storage appear to have been overcome. There appears to be enough reserve capacity in the equipment to handle the most adverse conditions likely.

In the spring of 1968 the Curator visited all States except Tasmania and made personal contact with most wheat research workers in the Commonwealth, to see how best to organize the Collection to service these people, and to seek their co-operation in setting-up the Collection.

The original Tamworth Variety Collection and a large proportion of the Durum segment of the U.S.D.A. World Wheat Collection introduced by the Tamworth Research Station was transferred to the Collection building. Together these totalled nearly 4,000 lines.

Subsamples of all Collections in Australia were sought and readily supplied. Apart from the Tamworth Collection, seed from twelve Collections was received. Many varieties occur in more than one Collection, some occur in all thirteen, and some more than once in the same Collection. These Collections were listed and arranged so that all lines carrying the same name were sown together.

During the growth of the crop and when the wheat is ripe a decision will be made on whether the lines carrying the same name may be considered to be the same variety and, if so, these will be bulked as a single entry in the Collection.

Hence, although over 10,000 different receivals have been sown, it could be that only a little over half this number of lines will finally be accessioned into the Collection.

Also, over 2,000 durum lines whereof fresh seed is available were not sown during 1969, while several hundred pots were sown in a glasshouse—of lines where the seed supply was very limited.

Quarantine

The Curator has been appointed an Inspector under the N.S.W. Plant Diseases Act, and a Quarantine officer under the Commonwealth Health Act, to facilitate the introduction of wheat from overseas.

The Commonwealth Department of Health (Plant Quarantine) has agreed to provide \$15,000 for erection of a Plant Quarantine Glasshouse, at Tamworth, and also the funds for its maintenance—including the pay of one labourer.

Meantime, wheat is being introduced and quarantined in the existing facilities at Tamworth. Wheat requested has been received from Yugoslavia, Canada, U.S.S.R., and Switzerland.

Services by the Collection

Although not yet properly functioning, since no harvesting has yet been done nor any seed placed in permanent storage, the Collection has already supplied seed to four countries—France, U.S.A., U.S.S.R., and Uruguay—and met twelve requests for seed within Australia. The signs are that once the Collection is fully functioning it will be widely used both by Australian and overseas workers.

Data Processing for the Collection

A lot of information about many of the lines received is available, although much of it has to be extracted from records in all parts of Australia. This will take a great deal of processing, firstly to assess reliability and secondly to put it into usable form. A start has been made. At the same time, an exploratory study relative to using the Department's Automatic Data Processing service is under way.

WHEAT BREEDING

Bread Wheats

Baking-quality evaluation of advanced lines in the early and early-midseason maturity groups produced disappointing results.

The selection 8127/266, submitted to the Uniform Quality Testing Committee, showed a tendency to overstability and was judged unsuitable for premium-wheat receival.

Promising semi-dwarf lines also failed to live up to earlier expectations. The low-quality Mexican parent has an overriding effect on baking performance of most of the selections, despite several generations of back-crossing.

On the other hand, two later maturing strains performed very well and have been promoted to the preliminary increase stage. One may be described as alternate, similar in behaviour to Festiguay. It is designated No. 221. The other, No. 237, is a true winter type. They are derived from local winter strains crossed with a Thatcher-Gabo backcross and have so far shown excellent grain quality and disease resistance.

Hybrid Wheats

Crossing continued to transfer sterility to a wide range of varieties. Sterile lines of Arawa, Mendos, Falcon, Gabo, Fortunella, Fedweb, Gamut, 8704, Moora, Gala, Glenwari, Marquis, Anniversario, Bencubbin, Festival, Galgalos, Charter, Willet, and Celebration are among the lines being developed.

To date, there has been little success with fertility-restoring lines. However, seed released by the Texas Agricultural Experiment Station and Crops Research Division, U.S. Department of Agriculture, was quarantined at the Agricultural Research Station, Tamworth, and is very promising. This will be screened for fertility-restoration this season and incorporated into the crossing programme.

To examine the expected increase in yield due to heterosis, a large number of varieties—some genetically similar and some genetically diverse—were hand crossed and a small yield trial was grown. The plants were harvested individually, and counts made on spikes/plant, spikelets/ear, seeds/ear, weight of grain per ear, and weight of grain per plant. Height of plants and ear length were also determined. The data are at present being analysed.

Durum Wheats

Yield trials were done at eleven sites in the northwest, from North Star south to Willow Tree. The lines tested were all semi-dwarf character, developed because Dural (the only variety adapted to Australian conditions) has tall weak straw which lodges readily.

Of the advanced lines, No 203 proved superior. Although the yields did not show this line to be greatly superior to Dural, the line did demonstrate ability to stand up under all weather conditions. This No 2030 has been approved by the State Wheat Improvement Committee to be submitted for registration this year.

A 5 hours test-mill run on No 2030 was made by Geo. Fielder and Co. Ltd, at their Tamworth mill; 2030 which had been grown at Narrabri, Moree, and Gunnedah. The results indicated that it has milling yield superior to Dural, and a better yellow colour. This season 2030 is being grown at six sites, for a further test run.

Dural has another disadvantage in that it is late maturing. In the trials, several new durum selections as early maturing as Gamut yielded comparably with the bread wheats. Line 56,111 was the most promising of these.

Crosses were made with selected varieties from the United States Department of Agriculture World Durum Collection, to increase the yield potential in the breeding lines. The varieties used in the crosses were selected for early maturity, disease resistance, plant height, head shape, colour and size of grain, shape of leaves, and habit of plant.

Time-of-sowing of durums is being studied. Initial results indicate early May as the best time.

Harvesting difficulties have been experienced with durums in the past. But a new plot-harvester developed at the Agricultural Research Station, Tamworth, was used last season and handles the durums successfully.

PLANT PATHOLOGY

Verticillium Wilt of Cotton

Cotton diseases-research continued to occupy most of the plant pathologist's time. The main concern is *Verticillium* wilt, widespread soil-borne in the Namoi Valley. Important in most cotton-producing countries, its presence in the Namoi Valley threatens this area's capacity for high yields. Ecology studies have shown that *Verticillium* is not indigenous to the area; that probably it has been introduced by infected weed seed and subsequently increased on a wide range of broad-leaved weeds. In any case, the fungus is in fields comprising more than 50 per cent of the cotton acreage, and in some fields up to 70 per cent of the plants may be infected.

The current research programme was set out against that background in 1967. A few aspects are studied at a time, and the direction of research effort changes as new information arises. Some points of interest from this work are as follows:

Incidence of Verticillium in the 1968-69 Crop.—Incidence of infected plants was again high in areas that were known as heavily infested by *Verticillium*, but there was no apparent increase in the incidence of wilt by comparison with the previous year. After an excellent summer growing period symptoms were severe towards the end of March, 1969, and several growers were seriously concerned by the premature defoliation and possible effect of this on quality of the then not mature lint.

Strains of Verticillium in the Namoi Valley.—Dr W. C. Schnathorst of the U.S.D.A. recognizes differences in the virulence of *Verticillium* isolates attacking cotton. His tests of isolates from the Namoi Valley show that the "mild" rather than the "severe" strain is present in those soils. "Mild" and "severe" are relative terms, however; and refer to the reaction of these isolates to the variety Acala 4-42. Deltapine Smoothleaf, the most common variety in the Namoi Valley, is very much more susceptible to *Verticillium* than is Acala 4-42. Even so, provided that only the "mild" strain is in these soils the scope for improving resistance of the varieties here is greater.

Verticillium-resistance in Cotton.—There is evidence that cotton resistance to *Fusarium* wilt when combined with resistance to *Verticillium* wilt greatly enhances the plant's tolerance to "mild" strains of *Verticillium*. At Tamworth the plant pathologist is looking into the possible gain from incorporating *Fusarium*-resistance into varieties for the Namoi Valley.

The Biology of Verticillium in the Namoi Valley.—The continuing study of the biology of *Verticillium* in respect to conditions in the Namoi Valley, has revealed the following points of interest: *Verticillium* is almost certainly not indigenous to the Namoi Valley; more than 40 per cent of the examined broad-leaved weeds of the Namoi Valley—native and introduced—are susceptible hosts; the fungus is able to infect the roots of most, and reproduce without host-effect showing; plants differ in their ability to carry *Verticillium* as an innocuous root-inhabitant—e.g., soybeans in the seedling stage do not support the fungus well but the roots are extensively colonized by the time the plant reaches maturity; so, soybeans would not be a suitable rotation crop for cotton if the rotation were intended to check *Verticillium*; on some plants, e.g., grain sorghum, *Verticillium* behaviour after colonizing roots in the seedling stage is such that the crop could be useful in the rotation.

Why plants differ in ability to carry *Verticillium* is being studied. The answers might be usable to protect cotton.

Seedling Diseases of Cotton

In 1968-69 large areas had to be replanted because of seedling losses caused by *Pythium* spp. These fungi caused most severe damage in cool, moist conditions—when seedling vigor is greatly retarded. Many growers planted when soil temperatures were too low for good seedling vigor. Further losses followed a cold snap in the latter half of October, 1968.

Root Rot of Irrigated Safflower

Investigations were continued, in collaboration with research staff of the University of New England. Primitive parasites in the genus *Pythium* are the seeming cause; attacking roots damaged by movement of the Namoi Valley's self-mulching soils.

Maize Mosaic Virus, in Corn

Further studies of maize inbred lines for resistance to mosaic virus have revealed simple resistance in at least one line. The programme will continue in 1969-70, with assistance by maize breeders at Glen Innes and Grafton Agricultural Research Stations.

WHEAT FROST INJURY RESEARCH

Production of Resistant Strains

Following the 1967-68 discovery of superior frost-resistance in wheats collected in Afghanistan, much of the research effort has been devoted to the problem of transferring resistance to locally adopted varieties. This transfer has required the evolution of some new techniques, and their application to a segregating population.

To best use the controlled environment facilities, the maximum number of plants which can be grown in the available space had to be determined by experiments. Results with known-performance wheats showed that plant densities may be raised to the point where tillering is entirely suppressed—without affecting the relative resistance of different varieties.

This method has been applied to a segregating population from a double cross that includes three of the most resistant parents currently available. From tests involving over 4,000 plants, two F_2 families show promise of combining early maturity with frost resistance at least equalling that of the best parent. Superior selections from these are in further trials. These will provide 1970 field-plot material.

Reaction to Frosting of Ears

A field experiment severely frosted just before flowering indicated that frost-resistant varieties may maintain their superiority even after ear emergence. This was unexpected. It could open the way to use of earlier maturing varieties in many areas—with consequent yield improvement and disease escape.

Chemical and Allied Studies re Frost Resistance

Nutrients.—The continued chemical studies, of different levels of nutrients in relation to frost resistance in wheat showed that very high levels of sulphur, nitrogen or phosphorus had no effect. Also, low levels of phosphorus or potassium had no effect.

In the first experiments sulphur deficiency increased frost resistance more than did nitrogen deficiency, but later experiments showed that sulphur deficiency and nitrogen deficiency each increased frost resistance to the same extent. In effect, the first indications that sulphur deficiency was independent of nitrogen nutrition in increasing frost resistance were not verified. The effects of sulphur deficiency therefore appear to result from interference with protein metabolism.

The results have not provided a new lead for studies of the chemical basis of frost resistance.

Studies of Stem Injury Effects

Studies of effects of stem injury, on growth and nutrient uptake and translocation, were extended to field samples from several damaged crops.

In general, the results supported 1967-68 laboratory findings; that severe stem injury resulting in marked reduction in stem internode diameter, provided the stems do not bend over, does not necessarily interfere seriously with grain production. Of four crops studied, it was possible only in one to establish significant correlation between degree of damage to individual stems and the grain produced on each. Even in that case only 15-20 per cent of the variation in yield of individual ears could be attributed to frost effects.

Methodology: Artificial Freezing by Cold Airflow

After initial difficulties, a new method for artificially freezing wheat plant stems or ears was developed. It is cold airflow apparatus. The cold airflow method makes it possible to adjust to, and apply very accurately within the plant tissue, any predetermined freezing temperature between 0° C and at least -7.5° C.

PASTURES RESEARCH

Pasture research in the area is concerned with two environments:

- (1) The low altitude (about 1,200 ft) arable Tamworth area, where wheat is the major enterprise.
- (2) The granitic, grazing country of southern parts of the New England Tablelands.

1. The Low Altitude Tamworth Arable Areas

Pasture Species Evaluation.—In this environment, where both summer and winter-spring growing crops are basic activities, there is a marked lack of established pasture species—except for lucerne (Hunter River cultivar) and annual medics. The pasture species evaluation work is primarily with genera and species that have shown some adaptability to this environment. Single-row screenings have been curtailed until the more common species have been examined.

Plots of commercially available temperate grasses were sown with and without nitrogen in 1966, and heavily grazed at about two monthly intervals—to examine persistence. Some yield data were collected but persistence was the main criterion of evaluation. Commercial phalaris and Demeter fescue were the only perennial grasses surviving by 1968. Wimmera ryegrass regenerated without cultivation for 2 years, and Meriden for 3 years. All other ryegrasses and cocksfoots disappeared within 3 years.

A range of phalaris cultivars sown in 1967 have also been heavily grazed regularly. The cultivar "Special Select" and the hybrid (*P. tuberosa* x *P. arundinacea*) have shown greatest persistence. Other cultivars are rapidly disappearing as a result of the severe seasonal moisture stresses. Sheep exhibit a strong dislike for the hybrid. They eat it only when nothing else is available. Commercial phalaris has performed poorly—for production and persistence.

Six lucerne cultivars had been sown in May, 1964. Early indications of the African cultivar's superior yield during winter have been followed by indications that yield of the African and Hunter River cultivars are similar, and superior to all others. All varieties persisted satisfactorily, including Cancreep and African. Yield determinations were ended in the 1967 spring. Since then, four sheep/acre have been grazed continuously, to examine persistence under set-stocking. All cultivars are declining in density. Hunter River has persisted best. African has declined most rapidly. Cancreep is intermediate.

In a range of lucerne cultivars established in 1968, one is Wairau—a New Zealand lucerne. This showed low tolerance to the hot dry summer climate here. Its stand density declined significantly over the summer. Hairy Peruvian and African, as in previous evaluations, exhibited superior winter-growth during the first winter. No evidence of creep has yet been detected in Cancreep.

Seven cultivars of subterranean clover and four of medic, as well as Namoi Vetch (*Vicia dasycarpa*), were sown this year—to examine the production and persistence of these winter legumes. The effect of seed set and hard seededness will be examined relative to persistence.

Three crownvetch cultivars (*Coronilla varia*) are being compared with Hunter River lucerne. So far the crownvetch establishment has been very slow. But this is characteristic of winter-sown crownvetch.

Root Nodule Bacteria.—In the wheat and the neighbouring non-arable hilly areas, the studies on root nodule bacteria have been mainly concerned with the lucerne-infective rhizobia. Examination of rhizobia from fixed sites between Tamworth and Narrabri since 1967 indicate that lucerne-infective rhizobia are in most soils, but very sparse in timbered, uncultivated red soils and less abundant in red soils in general. There is some indication of reduced populations with long term cultivation of cereals.

Nodules probably would form on sown lucerne on most of these situations without inoculation. But only about 67 per cent of the local strains were found to be fully effective in glasshouse tests of their nitrogen fixation. Strains from about 10 per cent of the sites gave virtually no benefit to the host legume. Until it is possible to predict reliably the presence of ineffective naturalized rhizobia, seed must be inoculated with fully effective strains to ensure a high level of nitrogen-fixation.

In the timbered areas, where some broadcast sowing of lucerne and other medics is likely, it is particularly important that seed be inoculated.

Grazing Evaluation of Pasture and Forage Species.—Lucerne, virtually the only perennial pasture plant sown in this environment, is potentially the basis of a feed year. Other species or pasture types contributing to the feed year in the Tamworth district are natural pasture with naturalized annual medics, summer forages and winter forages (oats).

About two-thirds of the Tamworth area is uncultivated, unfertilized natural pasture. Only 20 per cent of the area is sown to lucerne. The overall stocking rate of uncropped land is less than two Dry Sheep Equivalents per acre, but agronomic data from plots of lucerne has suggested a potential of six Dry Sheep per acre.

Initially the programme is examining individually each type of feed source, for some measure of its potential. Finally the programme will incorporate the various components in a feed year for the environment.

Grazing Evaluation of Lucerne.—Lucerne evaluation under a range of stocking rates (3.3 to 8.7 dry ewes/acre) started in November, 1966. Agronomic data had suggested that lucerne should support six dry ewes/acre. Data collected since the start of the experiments have indicated this is about right. At stocking rates above six sheep per acre the stand density has deteriorated severely. This deterioration has been due to a number of factors; the major one the sheep digging and subsequently eating the crowns. Also contributing to density loss has been the severe white fringed weevil infestation on the red soil; the weevil damaging some 90 per cent of plants and predisposing them to the effect of severe moisture stress—particularly in late summer, 1968.

Seasonal conditions in the past 3 years have featured virtual exhaustion of moisture by lucerne between falls of rain. Hence, lucerne has been totally dependent on incidental rainfall rather than stored subsoil moisture and—with low rainfall periods—production dropped sharply. A result of the moisture limitation has been that loss of plant density has not been responsible for significantly limiting yields—because there was compensatory growth by the sparse plants—until severe degradation has occurred. In the 1968 winter the highest stocking rate finally had to be discontinued, because of low plant density.

Substantial hand-feeding of lucerne hay has been needed for stocking rates above six sheep per acre but below this rate little feed has been introduced into the system.

Grazing Trial on Natural Pasture.—Natural pasture was considered as a potentially seasonal (spring and summer) adjunct to lucerne production. So, four stocking rates (1.0 to 4.0 dry sheep per acre) were applied to a botanically diverse pasture in December, 1967. Sheep at each of the stocking rates maintained good condition and they have not at any time been removed from the trial. A feature of the data so far is that the potential of this pasture with fertilizer is much greater than has previously been considered possible. Dry-matter production for 1968 was in excess of 8,000 lb per acre. Annual medics are making a very significant contribution to winter productivity.

Lucerne Management.—The productivity and persistence effects of various frequencies and intensities of lucerne defoliation were commended in 1967. The effect of stubble is to reduce productivity.

Patterns of accumulation and depletion of root reserves of lucerne under various stocking rates and two management systems are being followed biochemically.

Effect of sowing rate on the creeping ability of Cancreep lucerne is being examined. Plots were sown in August, 1968. No creep is, as yet, evident for any sowing rate (1, 2, 4, and 8 lb/acre). Production at the lower sowing rates has been significantly less than at 4 and 8 lb/acre.

Animal Utilization Studies on Summer Forages.—In the 1967–68 season, rotational grazing management of Sudax appeared to have a slight advantage over the set-stocked treatment. The highest stocking rate (twenty-four dry ewes per acre for the period of the trial) was found excessive. Stock had to be removed early in the trial. At sixteen sheep per acre, feed supply was fairly well equated with animal needs for the 5 months of the trial. In 1968–69, when rainfall distribution was significantly better than in 1967–68, twenty-four sheep per acre were carried for 4 months. At lower stocking rates, feed was adequate for the complete period of the trial.

Production from *Sorghum alnum* in 1968–69 was better than in the previous year. A stocking rate of eighteen and twelve dry ewes per acre was carried for 3 and 4 months, respectively. At the low stocking rates, six dry ewes per acre, there was excess feed for the 4½ month period of the trial.

All sheep gained weight during their respective period on the summer forages (up to 0.3 lb/head/day). These sheep were 15 months old at the start of the 1967-68 season.

Management Trial on Hybrid Forage Sorghum.—Supplementary to the animal-utilization trial on hybrid forage sorghum was an agronomic-management study involving different intervals (3, 6, 9 weeks and maturity) between defoliation and various heights of cutting (ground level to 6 inches).

Preliminary examination of 2 years data has indicated that dry matter yields are greatly enhanced by less frequent defoliation and by leaving 6 inch stubble after each cut.

Lamb Growth Rates on Summer Forages, Lucerne and Natural Pasture.—Lambs weaned at 7 weeks were placed on Sudax, *Sorghum alnum*, lucerne (using a six-paddock rotation), and natural pasture, in January, 1969, and given *ad lib* feeding. Lambs on the summer forages performed very poorly (growth rate of 0.05 lb/head/day) whereas on lucerne and natural pasture a growth rate of 0.3 lb/head/day was recorded.

To examine the hypothesis that digestibility of the summer forages was too low for satisfactory lamb growth, lambs selected from each feed source were slaughtered and weights of intestines and intestinal contents were recorded. Lambs grown on summer forages had 50 per cent more in their intestines than did lambs from lucerne and natural pasture, suggesting that digestibility of the summer forages was indeed the main problem. Feed samples are being *in vitro* tested for digestibility.

2. The Granitic Grazing Country

Factors for Success of Legumes and Pastures.—The granitic soils are of very low fertility and low water-holding capacity. Nodulation, nitrogen fixation, production and persistence of commonly used legumes have been measured since 1965. Some nutrient studies were included, but the phosphorus and sulphur levels used in the experiments were based on other studies by the Department in the area. The experiments so far indicate:

(a) Root nodule bacteria populations remain sparse, but introduced clovers' lack of persistence is not a direct result of death of the bacteria. The bacteria survive for as long as the host regenerates. On the other hand, for annual medics the poor nodulation within 1 or 2 years of sowing probably contributes to their decline.

(b) In the first year, subterranean and white clovers sown into cultivated ground grow better than clovers sown into uncultivated ground but the superiority is not evident in subsequent years.

(c) Clovers respond markedly to an initial combined dressing of potash and minor elements (including molybdenum and boron) irrespective of cultivation. The response is stronger in the second and subsequent years. In pot trials lucerne has also responded well to this dressing. Further study of these responses is necessary.

(d) To lime there is no response, in the field or in pots, by clovers or lucerne.

(e) Under full nutrient conditions, using the percentage nitrogen of associated perennial grasses as a measure, legumes in the field do not release nitrogen until after the spring growth of the legumes is complete.

(f) Forage production by associated grasses is better with subterranean clover than with any other of the ten legumes tested. This is thought to be because of early release of the large quantity of fixed nitrogen, combined with lack of competition for moisture by this legume during early summer and autumn.

(g) Cocksfoot, phalaris and fescue persist in the absence of legumes for more than three years, but production is closely related to supply of nitrogen. Perennial ryegrass does not persist well under any conditions. Grass growth, comparable to that obtained in the presence of subterranean clover, requires annual nitrogen dressings of 60-90 lb N per acre.

(h) Best legume growth is with lucerne but its competitive ability results in almost complete disappearance of associated grasses.

On the basis of these studies, and those of phosphorus and sulphur, and of work by the University of Sydney on regeneration of subterranean clover, it should now be possible to establish and maintain a high-producing, simple mixture of subterranean clover and introduced perennial grasses. The work also strongly supports the use of lucerne in a pure sward. African lucerne has performed well but has not been superior to Hunter River. Other varieties are currently under test.

WHEAT YIELD AND DEVELOPMENT STUDIES

Four wheat varieties (Gamut, Festiguay, Mexico 120 and 8127) were sown with and without superphosphate at four sowing times (6 June, 28 June, 16 July, 13 September).

Gamut and 8127 grain yields were higher for the second time of sowing than from the first. From then with these two varieties, and from the first time of sowing with Mexico 120 and Festiguay, yields fell almost linearly with later sowings.

Mexico 120 produced the highest yield, from each time of sowing. At the first time of sowing, 8127 outyielded Festiguay and Festiguay outyielded Gamut. Apart from this there was little difference between Gamut and 8127, and Festiguay consistently produced the lowest yield.

Application of superphosphate hastened the onset of a given physiological stage (up to the soft dough stage) by 1 to 3 days, and led to an average of 60 per cent in dry matter at ear initiation. The dry matter increase resulting from superphosphate application dwindled to about 14 per cent at maturity. At this stage it had increased by about 19 per cent the number of heads.

Mexico 120 had a consistent yield response trend to superphosphate at the first three times of sowing, whilst Gamut and 8127 responded only at the second time of sowing. Festiguay yield showed no response to superphosphate.

Thus, increases in dry matter and head numbers caused by superphosphate were not paralleled by yield responses.

The last sowing was 99 days after the first. This led to a reduction of some 73 days in the period from sowing to maturity.

Strong linear relationship between dry matter and yield is apparent, with a higher harvest index for Mexico 120 than the other three varieties.

Other data taken, and yet to be fully evaluated, include photosynthetic areas, yield analysis data, and soil moisture (with neutron moisture meter). Nitrogen and phosphorus rate of uptake by the plants are also to be determined.

Agricultural Research Directorate, Wollongbar Station

The research under this Directorate is done by officers positioned at Wollongbar Agricultural Research Station by various Divisions of the Department. Accounts of the work are appropriately incorporated elsewhere in this Report of the Department, viz., within the Division of Plant Industry, Division of Animal Industry, Division of Science Services and Division of Marketing and Agricultural Economics sections. A summary only of research progress is provided in the following notes.

For Division of Plant Industry.—Pasture species work was restricted this year to observing the areas and soil types best suited individual sub-tropical species.

Plant nutrition research on several soils confirmed the deficiencies, in varying degrees, of nitrogen, phosphorus, sulphur, potassium, calcium and molybdenum. Differences between various pasture species in their nutrient needs were also defined.

Pasture establishment investigations revealed a possible cause of tropical legume failures. Seed in the water-imbibing phase of the germination process was killed by relatively short exposures to the higher temperatures in the field.

Oats investigations showed the varieties most suitable for the region, the fertilizer required, and the best methods of establishment.

"Whole-farm feed-year" projects continued to show that increased animal production can be had under commercial conditions by applying the results of feed-year research.

Weeds ecology research defined the environmental conditions governing Crofton weed occurrence, and developed mechanical and chemical control methods.

Pasture-utilization studies, co-operative between Division of Plant Industry and Division of Animal Industry have been incorporated in the report of the latter Division.

For Division of Animal Industry.—Time-of-calving experiments revealed little difference in butterfat production between spring and summer-calved cows.

Production research involving the grazing of nitrogen top-dressed grass pastures showed that butterfat production can be much increased by nitrogen fertilizer usage, but that high stocking-rates are essential to maximize pasture utilization and animal production.

Grazing trials on several grass species fertilized with nitrogen indicated inherent differences between species in potential for butterfat production.

Production research on tropical legume/grass pastures again showed the importance of the legume component in raising butterfat production.

Preliminary experiments with the multiple suckling of calves on foster mothers indicated that this offers a means of increasing beef production from the dairy herd.

Research on the nutrition of the grower pig showed that rate of feeding affects response to different meat meals, that corn/meat meal and sorghum/meat meal diets are inferior to those containing other grains, and that the limitation to growth with corn/meat meal is due to deficiencies of two amino acids.

For Division of Science Services.—Entomological investigations were centred on the ecology and control of the important pasture pest *Amnemos weevil*. The work is at the stage where the insect's life cycle is relatively well known, where some recommendations for its control have been made, but where more work is needed—to fully understand its behaviour and ecology, and to improve on the recommended control methods.

Plant pathological investigations were concerned mainly with vetch diseases, "Kikuyu Yellows" disease, and diseases of tropical fruits. The work has shown that some measure of vetch disease control can be achieved. Some progress was made in the identification of the cause of Kikuyu Yellows. For banana leaf diseases the control programme was further refined, with special reference to the aerial application of sprays.

Chemistry investigations involved mainly the refinement of analytical techniques, to facilitate satisfactory analysis of samples from other research programmes.

For Division of Marketing and Agricultural Economics.—Economics research was concerned largely with development of a computer linear-programming model for use in selecting optimum feed-year programmes; a programme commensurate with the resources of the respective farm.

Economic aspects of the "whole-farm" research projects were also studied. These studies highlighted the factors which contribute most to the economic success of farm development programmes.

Other economics research included: formulation of drought strategies for dairy farms; evaluation of the Feed Year Assistance Scheme, and evaluation of the Mastitis Control Programme.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

General and Introductory

HERBARIUM ACCOMMODATION

In mid-May, 1969, the Director and Chief Botanist and the senior horticultural officers, and clerical staff, moved from their previous quarters in the National Herbarium building to office space available through renovation of the adjacent fine stone residence occupied in an earlier era by the Botanic Gardens Director or Superintendent. The transfer has to an extent improved the working and storage space in the National Herbarium but the area for these purposes remains quite inadequate because of the appointment of more staff and the increasing collections of botanical material.

Despite its most inadequate accommodation the National Herbarium of the Royal Botanic Gardens, Sydney, is still one of the most active in research and handling also a large volume of service inquiries. Sketch plans for a new Herbarium building were prepared in 1966–67. Funds are still awaited for work to proceed on the project.

PLANT ECOLOGY RESEARCH INAUGURATED

With the appointment of a Plant Ecologist to the National Herbarium staff a new line of investigation was inaugurated, complementary to the long established taxonomic research.

Ecological investigation of the distribution of plant formations, with their component species, is a most desirable corollary to work on the natural range of and conditions controlling these species.

A COLD-CLIMATE ANNEX TO THE ROYAL BOTANIC GARDENS

A property situated at Mount Tomah on the Bell's Line of Road, consisting of some 78 acres of natural bushland and cultivated areas, on basalt and sandstone soils, has been donated to the Department. Action is being taken to complete the acquisition and undertake work to develop this area as a cold-climate annex to the Royal Botanic Gardens.

CONDITION OF THE GARDENS, DOMAINS, PARKS, GROUNDS

The Royal Botanic Gardens, Outer and Inner Domains, Government House Grounds, Admiralty House Grounds as well as Centennial and Queens Parks have all been satisfactorily maintained, and a number of improvements achieved. Development has been most noticeable in Centennial Park. Special funds were again made available for there, additional to the regular maintenance vote.

SOME STAFF NOTES

Botanist Mr D. J. McGillivray has been appointed Australian Botanical Liaison Officer at the Royal Botanic Gardens, Kew, England. During about 18 months there he will on request do investigations for all Australian botanical institutions as well as extend his own taxonomic research in special groups of plants. He will visit European Herbaria in his course of duty, and on his return journey will visit botanical institutions in America and the Pacific area.

Dr Mary D. Tindale and Dr Barbara G. Briggs have been reclassified by the Public Service Board, as Senior Research Scientist and Research Scientist respectively, from 1st June, 1969. Botanist Mr D. F. Blaxell commenced duty in August, 1968, filling a vacant position. Appointed to the newly-created position of Plant Ecologist, Mr J. Pickard took up the duties on 9th January, 1969.

Part-time Botanist Mr O. D. Evans retired from this position on 30th June, 1969 but on an honorary basis will continue to collaborate in the compilation of the *Flora of New South Wales*.

Mr R. G. Coveny formerly of the horticultural staff was appointed to the vacant Botanical Collector position.

Mr W. Lester resigned from the position of Assistant Superintendent, Royal Botanic Gardens, on 31st August, 1968. As yet there has been no satisfactory applicant for the vacancy. Mr A. Tillsley has been promoted to the position of Chief Propagator vacated by the resignation of Mr A. May to take a position at the Royal Botanic Garden, Hobart, Tasmania.

Turnover of staff remains a problem in the horticultural activities of the Royal Botanic Gardens and allied areas. Losses this year totalled fifty-one (including four retirements) and the appointments fifty-two. Resignations included twenty-nine Garden labourers. With so many changes in staff, continuity of works is difficult.

National Herbarium

BOTANICAL RESEARCH

Publications

"Contributions from the New South Wales National Herbarium".—No issue was published this year but copy for volume 4, No. 3 was prepared for press. It contains ten research papers, on the following: New algal records; a toxic alga; Lemnaceae; a new species of *Viscum*; notes of *Platylobium*, *Bossviaea* and *Templetonia*; *Isotoma fluviatilis*; Botany of Cook's first voyage; chromosome numbers in Oleaceae; chromosome numbers in *Eleocharis*; new taxa in *Acacia*. The revision of *Poa* in Australia by former Senior Botanist Dr Joyce Vickery, was also prepared for publication.

The "Flora of New South Wales" Series.—A treatment of Viscaceae (contributed by Dr B. Barlow, Flinders University of South Australia) was received. Necessary additions were made, and to Dr Barlow's treatment of Loranaceae, preparatory to publication. Material on Cyperaceae and Papilionaceae is in preparation.

Other Publications.—The Presidential Address to the Linnean Society of New South Wales ("Rainbow's End: The Quest for an Optimal Taxonomy") by Mr L. A. S. Johnson, Deputy Chief Botanist was published in the Society's *Proceedings*. This paper critically reviews the theoretical foundations of taxonomic classification. A brief note on *Parahebe* was published in *Taxon*.

A substantial paper on *Acacia* phytochemistry, representing joint work by Dr M. Tindale and by Professor D. L. Roux of Bloemfontein, South Africa, was submitted to the *Journal of Phytochemistry*.

For reproduction of H. M. R. Rupp's *Orchids of New South Wales*, to appear in September, 1969, a detailed appendix has been completed.

Projects Completed or Proceeding

Investigations in *Eucalyptus* continued in collaboration with Professor L. D. Pryor of the Australian National University, Canberra. Further manuscript covering a new system of classification of the genus was prepared.

Phytochemical studies on *Acacia* species progressed, and revision of the *Acacia decurrens* group neared completion.

In cytotaxonomic investigation of Restionaceae further chromosome studies have been done in a number of genera, chiefly from Western Australia.

The Australian species of the *Veronica* group have been, the subject of further cytotaxonomic studies, especially in the alpine genus *Pygmaea*.

Studies in Proteaceae and in the Australian species of *Galium* and *Dodonaea* have been continued at Kew by Mr McGillivray during his term as Liaison Officer.

Revisionary studies in *Bossiaea*, Casuarinaceae and *Juncus* continued.

Studies in *Lomandra* and *Xanthorrhoea* have been resumed as new problems have come to light.

Revision of *Tetralochea* continued as part of the Flora of New South Wales project.

Preliminary investigations of the genus *Plantago* have thrown light on a number of problems in the delimitation of species.

Studies of variation and general biology of Lemnaceae continued and many of the results have been submitted for publication.

Revisionary studies have been begun on Australian species of the grass genus *Stipa*, and on a number of groups of Australian orchids.

Research continued into the seasonal growths of the Blue-green Alga *Anacystis cyanea* involved in poisoning of stock watered from farm dams in certain areas.

Ecological investigation of inter-tidal algae and marine animals at Cape Banks continued. Results are being analysed before publication.

A general survey of the plant communities of New South Wales has been initiated as a long-term project, through the appointment of an ecologist.

Field Investigations

Ecological investigations partly related to proposals of areas for nature conservation have been made on the north coast (heathland, headland and rainforest communities), in the Wolgan-Mt Coricudgy districts, and on the Liverpool Range.

Algal ecology was investigated in the Cape Banks, Braidwood and Illabo districts in connection with the aforementioned research projects.

Extensive areas in the western and far-western plains were visited by botanists investigating various groups—especially grasses, chenopods and eucalypts.

Queensland's Mackay and Blackdown Tableland districts were visited for *Eucalyptus* research. Staff also collected extensively in Queensland, the Northern Territory and South Australia while on leave.

Botanists visited the Kosciusko, Upper Geehi River, Bredbo, Monga, Nerriga, Sassafras, Minnamurra Falls, Madden's Plains, Wiseman's Ferry, Gosford, Berrico and Gloucester Tops, Curricabark, Barrington Tops, Nundle, Goulburn River, Liverpool Plains and Coonabarabran districts—studying particular groups and collecting material.

Interstate Visits

The Director visited Brisbane for the opening of the new Queensland Herbarium at Indooroopilly. The Queensland Herbarium and Adelaide Herbaria were also visited by botanists, pursuing their research projects and for discussions with staff there.

PLANTS NEWLY RECORDED FOR NEW SOUTH WALES (Species not native in Australia are indicated by an asterisk)

Acacia maitlandii, NW of Bourke; previously known from Northern Territory and the south-west of Queensland.

Atriplex acutibractea ssp. *acutibractea*, "Byrnedale" near Menindee; known from South Australia.

Bassia tetracuspis, between Mungindi and Boomi; hitherto known from southern Queensland.

**Desmodium gangeticum*, near Kyogle; an Asiatic legume previously naturalized in Queensland, possibly of some value in tropical pastures.

Eleocharis caribaea, Angourie, NE of Grafton; widespread in the tropics.

**Euphorbia falcata*, Gilgandra; native of Europe and Asia.

Homopholia belsonii, Terry-Hie-Hie; a grass known from southern Queensland.

Kochia radiata, "Bidura", NW of Balranald; previously known from South Australia and Victoria.

Olex sp., Diggers Camp, SE of Grafton; an undescribed species not known elsewhere.

Pierostylis acuminata var. *ingens*; Carabost Creek near Wagga; known from Victoria.

**Rosa canina*, Murrumbidgee River, Balranald; native of Europe, naturalized in Victoria and South Australia.

**Rubus cuspidifer* (probable identification), Tumbarumba; a European "blackberry" naturalized also in Victoria.

**Rubus leightonii*, Robertson and Saddleback Mountain, near Kiama; another European "blackberry".

**Rubus ursinus*, St Ives; a "blackberry" from the Pacific Coast of North America.

**Vulpia membranacea*, Lake Burrill, near Ulladulla; a native of Europe.

RARE SPECIES AND EXTENSIONS OF RANGE

Abarema hendersonii, Seal Rocks, S of Forster; previously known from Coff's Harbour northwards.

Callitris rhomboidea, Diggers Camp, SE of Grafton; this extends by about 60 miles the known northern limit of this "Cypress Pine".

Ceratopetalum gummiiferum, near Evans Head; this species, the "New South Wales Christmas Bush", was not previously known north of Angourie.

Cuphonotus sp. ("*Capsella andreana*"), two separate collections in the Brewarrina district; first collections since 1900.

Darwinia leptantha, Crowdy Bay, NE of Taree; a northerly extension of some 25 miles.

Eucalyptus incrassata, Koraleigh, SE of Balranald; collected previously in New South Wales from only two other western localities, though common in Victoria, South Australia, and Western Australia.

Eucalyptus luehmanniana, 7 miles SW of Nowra; known from Gosford to Bulli.

Eucalyptus triflora, locally common on sandstone crags east of the Endrick River near Nerriga; formerly known from only two points in this area.

Glinus oppositifolia, Maclean; first collection from New South Wales coast though common in inland Australia and the tropical Queensland coasts.

Kunzea sp., Narrabarba; second known collection; previously collected at Mt Imlay and on the far South Coast.

Medicosma cunninghamii, Seal Rocks, south of Forster; first collection for 70 years; a southward 200 miles extension from the Richmond River.

Panicum laevifolium, Wilcannia; this grass, previously known in this State only from the western slopes and tablelands, is strongly suspected of causing sheep photosensitization.

Paractaenum novae-hollandiae, 11 miles W of Wilcannia; a southerly extension of known range from the Milparinka district.

Phyllanthus hebecarpus, summit of Mt Nombi, near Mulalely; first record since 1904.

Poa fax, 30 miles NW of Balranald; known from Narrabri, Liverpool Plains, Lake Cargelligo, and in Victoria.

Prasophyllum wilsoniense, Mt Kerry, NE of Rylstone; northward extension from Mt Wilson, Blue Mountains.

Pterostylis longicurva, Braidwood; previously known only from the northern half of New South Wales.

Ranunculus undosus, Liverpool Plains; rarely collected.

Restio longipes, Vines Creek S of Nerriga; previously known only from a single locality near Clyde Mountain.

Veronica arguta, Mt Coricudgy, E of Rylstone; previously known from a restricted range in the Blue Mountains.

SIGNIFICANT COLLECTIONS FROM OTHER STATES

Acacia moutfordiae, East Alligator River, Northern Territory; a very rarely collected species.

Amyema gaudichaudii, 20 miles NE of Jandowie, Queensland; this mistletoe was previously known in Queensland only from Inglewood, near the New South Wales border, though common near Sydney.

Emblingia calceoliflora, Exmouth Gulf, Western Australia; a very rarely collected plant of uncertain affinities.

Pterostylis rufa var. *aciculiformis*, near Toowoomba, Queensland; first record for that State.

BOTANICAL EXCHANGES

Botanical Specimens.—The system of exchange with botanical institutions overseas and in Australia was maintained. Specimens received totalled 570 from five overseas institutions, 2,946 from Lae, New Guinea, and 2,916 from eleven Australian institutions. Specimens dispatched totalled 1,800 to fifteen overseas institutions and 790 to six Australian institutions.

Special Collections.—A further large number of wood samples of *Acacia* was specially collected and sent to Professor D. G. Roux, of Bloemfontein, South Africa, to further the collaborative studies on *Acacia* chemosystematics.

Fresh, dried, or fixed material of species of various families has been specially collected for botanists, chemists, horticulturists, and pharmacologists in Australia and overseas.

Seed Exchange.—A new edition of the *Index Seminum* was published and distributed widely to 450 botanic gardens, similar institutions and interested persons throughout the world. Details of collection localities are now provided in this list of seeds available from this institution.

Some 2,250 packets of seed were sent on request to various overseas and Australian institutions, as against 150 packets in the previous year.

The Botanical Collector.—The Botanical Collector spent some 55 days in the field collecting seed and herbarium specimens for record and exchange; other plant materials specifically required for research in the National Herbarium and to meet other institutions' requests.

Extended trips were made to the Mt Coricudgy and Hill End, Macleay River, Gloucester and Curricabark, and Liverpool Range districts, and shorter trips to many localities within 100 miles of Sydney.

BOTANIC MATERIALS BORROWED OR LOANED OR DONATED

Valuable collections were received from Mr C. H. Gittins (Cape York Peninsula, Queensland), Mr F. Turvey (north of South Australia and Northern Territory), Mr F. Lullfitz (Kimberley district of Western Australia), Mr N. Byrnes (Darwin area), Professor N. C. Beadle (700 North American plants), the University of Sydney (New Zealand and New Caledonian

plants collected last century by Dr Sinclair), Mr A. C. Beauglehole, of Gorae West, Victoria (many parts of Australia), several donors (collections of living native orchids).

Important loans included: *Astrebla* (CSIRO, Canberra); Haloragaceae (State Herbarium of South Australia); *Hibbertia* (Canberra Botanic Garden).

Loans returned included *Notelaea*, recently revised by Mr P. Green of the Royal Botanic Gardens, Kew.

PROFESSIONAL VISITS TO THE HERBARIUM

Study Facilities.—Many notable visitors from overseas and from Australian scientific institutions were welcomed at the Herbarium. They were granted facilities to study and consulted with the staff on the relevant studies. Botanists or the Botanical Collector accompanied some of the visitors on field trips.

Overseas visitors included: Dr Grady L. Webster, University of California, Davis; Lady Cook, University of Uganda; Mr Chinnock, New Zealand; Dr B. Tomlinson, Fairchild Botanic Garden, Florida; Dr Lee, Cornell University, Ithaca, U.S.A.

Visitors from Australia and New Guinea included: Mr N. Hall and Mr G. Chippendale, Forest Research Institute, Canberra; Dr M. E. Phillips, Mr D. Verdon, Mrs J. Pulley, Miss E. Canning, Canberra Botanic Gardens; Professor N. C. W. Beadle, University of New England, Armidale; Miss Myint Myint San, University of Queensland, Brisbane; Mr A. George and Mr I. Lethbridge, Western Australian Herbarium, Perth; Mr D. Symon, Waite Agricultural Research Institute, Adelaide; Dr J. A. Carnahan, Dr D. Anderson, and L. D. Pryor, Australian National University, Canberra; Dr Weidemann, Division of Land Research, CSIRO, Canberra; Mr J. S. Womersley, Mr A. W. Dockrill, and Miss J. Vandenberg, Herbarium, Botanic Garden, Lae, New Guinea; Dr P. Michael and Miss V. Hull, Division of Plant Industry, CSIRO, Canberra; Mr J. B. Kirkpatrick, Geography Department, University of Melbourne; Mr J. Maconochie, Northern Territory Herbarium, Alice Springs; Miss J. Galbraith, Tyers, Victoria; Mr R. L. Correll, Botany Department, University College, Townsville.

Botanists and other scientific workers stationed in Sydney also visited the Herbarium for study or discussion.

MISCELLANEOUS AND SPECIAL SERVICES

Special Services by Staff Members.—Mr Johnson continued to serve on the Council of the Linnean Society of New South Wales, and on the Parks and Reserves Scientific Committee—advising the Minister for Lands—and visited the Minnamurra area in connection with the Committee's surveys. Also in connection with this Committee's investigations, Mr Blaxell and Mr Pickard visited several north coast, Hunter Valley and central tablelands areas and furnished reports.

Dr Tindale continued as Secretary of the Systematic Botany Committee of Section M of A.N.Z.A.A.S., and her membership of the Special Committee for Pteridophyta of the International Association of Plant Taxonomists.

Dr Briggs continued as a member of the Systematic Botany Committee and of the Editorial Board of the international journal *Evolution*. She was also elected to the Council of the International Organization of Plant Biosystematists.

Police, Customs, and Excise Activities.—Information and identifications were furnished to the Police Department and to the Commonwealth Department of Customs and Excise on matters concerning drug plants, prohibited imports, and plant material providing evidence in criminal cases. Court appearances were made in some instances.

Postage Stamp Floral Emblems.—Advice to the Post Office helped to produce an attractive series of stamps featuring State floral emblems.

Lectures, etc.—Lectures, seminars, and talks were given by botanical staff to various institutions and groups.

HERBARIUM LIBRARY

New material totalled 1,767 items (109 books, 1,121 issues of periodicals, 484 pamphlets, 44 boxes of microfiche cards, and sundry maps and trade publications). Of these, 332 items were catalogued. Periodical articles indexed totalled 922. Donations to the library, included in the new material, comprised 28 books and four sets of periodicals.

Loans from the library to members of staff totalled 1,218; and to other libraries 274.

Royal Botanical Gardens

The Gardens were maintained in good condition and a number of improvements were effected. Public interest and enthusiasm in the various activities were evident in the many favourable comments.

Acquisition of New Area

Formal acceptance of a unique, valuable, and partly developed property of about 78 acres at Mount Tomah is under way. The owner is donating this to the Royal Botanic Gardens for development as a cold-climate annex. The area comprises both basalt capping and sandstone country. A wide range of cold-climate species has been cultivated on it for some years.

Improvements Effected

Improvements were considerable. The principal projects were: an additional public entrance from Mrs Macquarie's Road, and associated construction of sandstone paving steps and footway; construction of walling and paving, with associated planting, to further the landscape treatment of surrounds to the new Administrative Offices; provision of sandstone walling, paving, and seating in the eastern sector of the Lower Garden; further re-alignment, re-formation, and kerbing of roads and footpaths in the Lower Garden, and the related re-grading and re-planting of adjacent shrubberies and lawns; extension of exhibition plantings, adjacent to the Victoria Lodge entrance gates and in other established plantings; continuation of replacement of expended galvanized water services with copper services. Many other minor constructional and renovation programmes were completed.

Nursery

Expansion of the range and quantity of material continued, with propagation and development of local and overseas introductions. Liaison and exchange of material with kindred institutions, specialist plant societies and individuals, local and overseas, contributed significantly.

Production and maintenance of nursery stock continued satisfactorily. Enough material for the re-planting and landscape development projects, and for massed seasonal floral displays, were provided.

Nursery facilities were further improved, by replacing earth-filled plant-holding areas with asphaltic surfacing and by constructing various covered storage and work areas.

Glasshouses

Public displays of selected flowering species, ferns, and ornamental foliage plants were continued. Several hundred new species and hybrids, mainly in the family Cactaceae, Crassulaceae, Euphorbiaceae, Orchidaceae, and Bromeliaceae, introduced from various sources, were added. This further enhanced their botanical value.

Several very old glasshouses, deteriorating as mentioned last year, continue to handicap the appearance of this important display area. Replacement with a complex of modern environment-controlled units in an area more prominent and accessible to the public is now an urgent need.

Provision of plants and floral decorations for Parliament House and official areas at the Sydney Royal Show continued, as was the supply and maintenance of decorative material in Government offices.

Royal Agricultural Society Awards

The Royal Botanic Gardens for the second successive year exhibited horticultural material in open competition at the Royal Agricultural Society's Easter Show with notable success. Awards gained included 27 Championships, 56 First and 65 Second Prizes as well as the trophy for the Most Successful Exhibitor in Foliage, Flowering and/or Berry Plant Classes; other major awards, for the best exhibits in particular sections of these Classes, and the bronze medal as runner-up for the Banksia Medal—the highest award made by the Royal Horticultural Society, England—in this instance awarded to the exhibitor winning the highest prize money total in all classes of the Horticultural Section of this Sydney Royal Show.

Landscape Designing and Associated Services

Internal.—Apart from directing landscape works associated with general developments within the Royal Botanic Gardens and Domains, and restorative or developmental works at

Centennial Park, the main projects comprised: preparation of plans for walling, paving, and seating in the Lower Garden; extension of exhibition plantings adjacent to Victoria Lodge; planting native tree species in the north-east sector of the Lower Garden; extension of tree planting along the southern alignment of the Cahill Expressway; extension of existing ornamental plantings within the Royal Botanic Gardens and Government House Grounds; providing an additional public entrance off Mrs Macquarie's Road in the Domain; and the walling, paving, and associated landscaping of surrounds to the new Administrative building.

External Services.—Site inspections were made and plans and/or reports were prepared for landscape development of: Wollongbar Agricultural Research Station; Glenfield Veterinary Research Station Virology Building; N.S.W. Nurserymen's Association National Rose Garden, Baulkham Hills; Wollongong Teachers College; Ormond School, Child Welfare Department; May Villa Child Welfare Centre; Parramatta Training School for Girls; Clemton Park Public School; Coolah District Hospital; Mercy Hospital, Young; Geigy Research Centre, Kemp's Creek; Officers' Mess Area, Victoria Barracks.

Advisory visits concerning the grounds development and maintenance problems of other authorities included: Ashton Park Trust; Vaucluse House Trust; Mosman Municipal Council; Newington State Prison; HMAS *Waterhen*; Ryde District Soldiers' Memorial Hospital; Prince Henry Hospital; Hurlstone Agricultural High School; Hunters Hill High School; Daceyville Public School; Kogarah Public School; Bardwell Park Infants School.

Educational and Extension Activities

Exhibitions.—An educational exhibition of various coniferous plants, requested by the Royal Horticultural Society, was staged in the Queen Victoria Building as part of the Waratah Spring Festival activities. Official, trade, and other exhibitors as well as members of the general public gave the highest commendation to the standard of presentation, and further requests for participation in similar displays in 1969 and 1970 have already been made by the Royal Horticultural Society and the Royal Agricultural Society.

Many potted plants of poisonous species were made available to the Occupational Health Section of the Department of Health for a Poison Plant Exhibit at Macquarie University.

Lectures and Talks.—The Senior Landscape Designer delivered a further series of lectures to University of Sydney post-graduate students of Town Planning.

The Royal Botanic Gardens Superintendent delivered an address to Park Supervisors at a field day held at Swanes Nursery, Dural; an address to the Carlingford District Lions Club; and—at the invitation of the Sydney Technical College authorities—3 hours of lectures on the history, development and administration of the Royal Botanic Gardens and allied areas, to students in the Park Administrative post-certificate course at the Ryde School of Horticulture. This course was initiated by him as a member of the Special Sub-committee of the Horticultural Advisory Council of the Ryde School of Horticulture.

Enquiries.—Requests to the Royal Botanic Gardens for horticultural information are increasing. They indicate a trend in public demand for specialized advice and consultations concerning environmental horticulture.

Garden Study Tours.—The Royal Botanic Gardens continued to receive the ever-increasing attention of student groups undertaking botany, horticulture, and associated study tours; groups in particular from the University of Sydney, University of New South Wales, and the Ryde School of Horticulture. Numerous primary and secondary school classes also visited the gardens for guided tours and talks.

Training and Development of Staff

Courses.—Fourteen officers undertook various stages of the 3-year Horticulture Certificate Course at the Ryde School of Horticulture. Three have completed it. Also, five voluntarily commenced 3-year Post-certificate Courses—three in Park Administration and two in Landscape Design. Two others undertook specialized horticultural training to increase their efficiency and/or fit themselves for higher positions.

Interstate Experience.—Royal Botanic Gardens Superintendent Mr W. R. Watson represented this institution at the National Conference, in Perth, of the Australian Institute of Parks and Recreation. Whilst there he inspected the Botanic Gardens, Kings Park, various other parks, horticultural centres and recreational areas in and around Perth, and made a 3-day field excursion in areas north of Perth.

Overseas Trainees.—An officer of the Urban Services Department, Hong Kong, satisfactorily completed 12 months intensive training in horticultural procedures at the Royal Botanic Gardens. In view of his success, Hong Kong authorities have asked that his stay here be extended for a further twelve months—to complete technical studies at the Ryde School of Horticulture. They also requested the training of a further officer of the Urban Services Department, and his period of intensive training started in March, 1969.

Assistance to Other Departments and Organizations.—Help in assessing and purchasing specialized park maintenance equipment was given to various Government instrumentalities and commercial organizations. Mutually beneficial close liaison was maintained with horticultural industry groups and other park authorities, and for the general good of the community and park-conscious people.

Weed Trials.—Various herbicidal trials for the control of Bindi-eye (*Soliva pterosperma*) were established in the Lower Garden in co-operation with the Weeds Section, Division of Plant Industry; towards determining the most effective control of this increasingly serious problem in the lawn areas.

Vandalism

Vandalism continued to be a problem. Fountains and floral bedding displays received most attention. Damage to descriptive plant labels is increasing.

The Domains

General.—The Inner and Outer Domains were satisfactorily maintained. The various improvements effected included: additional ornamental shade and shelter trees planted along the southern alignment of the Cahill Expressway between Art Gallery and Hospital Roads; construction of a dual rink bowling green for aged citizens; re-seeding and turfing of areas denuded of grass; improved surface condition of playing fields; removal of more of the Moreton Bay Fig trees which have declined in vigour; and extension of water services for irrigation.

Domain Baths Area.—Construction of the Domain Baths (owned and controlled by the Sydney City Council) was completed, as were restoration and landscaping of adjacent Domain land disturbed during the construction. Equitable responsibility for re-formation of the roadways is still unresolved.

Playing Fields.—Lunchtime winter sporting fixtures, now an established weekday Domain feature, continued. Demand for playing fields has increased and patronage has been maintained. Not less than 177 Rugby League, 247 Soccer, and 1,048 Basketball matches were played there in the past 12 months.

The grassed areas were used also for recurrent annual parades and assemblies associated with Australia Day, the Sydney Royal Show Procession, the Waratah Spring Festival, Apprenticeship Week, Education Week, and various other occasions including H.M.A.S. *Hobart*, Citation Ceremony, and the 2SM Youth Concert. The latter attracted 8,000 persons.

The Domain Lodge.—With the plans prepared by the Government Architect, restoration of the old stone residence at the Domain entrance near the Registrar-General's Department is nearing completion. An appropriate landscape setting is being prepared by designers attached to the Royal Botanic Gardens.

Art Gallery Extensions.—Construction of extensions to the Art Gallery is proceeding, in close liaison with the Royal Botanic Gardens staff. This followed submission of a modified plan, and the approval—by the Trustees of the Royal Botanic Gardens and Government Domain—of alienation of a certain area of Domain land in exchange for land at present under the Art Gallery Trusteeship.

Car Parking.—Parking to facilitate traffic arrangements during railway strikes was allowed several times in a large area of the Outer Domain, and severely damaged some of the grassed areas.

Naval Oil Storage Depot.—Work is well advanced on modifications to and extension of the substation attached to the Naval Oil Storage Depot, following agreement with the Commonwealth Department of Works. Without approval of the Trustees or the Department some cyclone-wire cages have been erected over inspection points to the oil tanks. Discussions are pending.

Government House

Inner Domain gardening staff maintained Government House Grounds and provided floral decorations for within the building. Ground improvements were effected, including: re-formation and planting of extended shrubberies on the southern border; extension of cut flower plantings, and of the range of

decorative species for indoor culture; demolition of a derelict shade house, and replacement with a concrete based pipe-framed structure covered with woven cloth; modification and extension of glasshouse heating and installation of overhead mist irrigation in continuation of previous work; and reconstruction of timber fencing at the western boundary of the service area.

Admiralty House

Royal Botanic Gardens staff maintained the grounds of Admiralty House, the Governor-General's residence, and provided interior floral decorations for this and Government House, Canberra. The Commonwealth Government reimburses the State.

Pleasing ground improvements included: removal of more of the old superfluous trees and shrubs, and replanting with new material; better lawn areas through herbicidal and fertilizer treatments; re-surfacing of main gravel drive; and modifications to the service area to provide a site for a new amenities block.

Centennial Park (including Queens Park)

Development.—To continue the policies formulated and operated by the inter-departmental Centennial Park Supervisory Committee which operated from May, 1964, until June, 1968, the Department secured, besides the funds for regular maintenance, further special funds for restorative and developmental works.

Special funds of \$40,000 allotted for the year brought to \$274,000 the total expended over the 5 years. During this time the horse-riding track has been reconstructed, new depot and office buildings provided, a number of ponds cleared and low-lying areas built-up and grassed, a wide range of operating plant purchased, part of the iron-and-stone perimeter fence restored, certain roadways renewed, and the first section of a large-scale irrigation scheme for the horse-riding track and playing fields installed.

Minister for Agriculture the Hon. G. R. Crawford twice visited the Centennial and Queens Parks to inspect improvements and to consider development of playing fields in Queens Park (see "Sporting Facilities", later). The Minister's policies were publicized on radio and in the press in consequence.

Maintenance.—Centennial Park and Queens Park were maintained at the high standard attained over the last few years; notwithstanding the long dry period wherein watering of the young trees and shrubs as well as the herbaceous beds became major tasks.

Floral areas, again a special feature, received commendation from the visiting public. Playing fields were topdressed and fertilized. The full benefit will be apparent when irrigation becomes effective in future years.

Plantings.—The long spell of dry weather restricted large-scale planting of trees and shrubs but some fifty *Liquidambar styraciflua*, *Casuarina cunninghamiana* ("River Oak"), and *Ficus microcarpa* var. *hillii* were planted out in the dog-training area at the southeast entrance, a further twenty-five *Ficus microcarpa* var. *hillii* at the eastern end of Parkes Drive beyond the Grand Drive, and, in Queens Park, sixty-five to seventy *Casuarina glauca* ("Swamp Oak") and *Pinus palustris* ("Southern Pitch Pine") on the hillside between the Grand Drive and Reservoir No. 2 (on the northern boundary of Centennial Park). Replacements of *Eucalyptus grandis* ("Flooded Gum") were undertaken where earlier plantings had suffered through the drought period.

Turfing was completed in the Gymkhana area (see later) and on the west embankment of Soccer Ground No. 4 in Queens Park.

Pond Clearance and Landscaping.—Attention was given to Pond No. 10, situated in the far-southwest corner of Centennial Park, adjacent to part of the old tram-track embankment bordering Alison Road, Randwick. The banks had become heavily overgrown with *Salix babylonica* ("Weeping Willows") and *Erythrina* sp. ("Coral Tree") while the waterway itself was almost blocked with reeds (*Eleocharis* and *Phragmites*).

The area was cleared of excess growth and the pond freed of the greater amount of reed. Also the pond was extended into a newly-developed northern bay, giving a vista of clear water not previously seen in this part of the park. Margins were graded and the general surrounds treated to reveal a flowing landscape towards the Grand Drive. This area will later be merged into the contiguous area to the east to be developed as a landscape of native plant species.

Sporting Facilities.—Considerable attention including application of fertilizer and resurfacing of cricket pitches, has been given to the playing areas in Centennial and Queens Park. With the early installation of large-scale irrigation these grounds will become first-quality areas. As their conditions are improving and an increasing demand is being made by sporting bodies, a reasonable fee system has been introduced. A basic charge was determined, to be reviewed as the facilities improve further—particularly when the fields are adequately irrigated.

Areas of Centennial Park were made available as usual for the equestrian dressage events and cross-country trials associated with the Royal Agricultural Society's Easter Show.

Gymkhana Area.—Turfing of the remainder of the area built-up during the previous year was completed. Irrigation was installed to facilitate maintenance over this stretch of the park much worn by dressage and other horse-exercising. The area has been closed until the grass cover is completely established.

Vehicular Parking Control.—The pipe-and-chain control measures so effective the previous year, near the Darley Street entrance to the Grand Drive, have been extended to other areas—from Pond No. 2 to Pond No. 6 and along Depot Avenue. These deterrents to parking on grassed areas have been effective where installed, but many roads in the park should not be so treated. These traverse open parkland where post-and-chain would spoil the appearance. Kerbing, such as was done in the previous year on Parkes Drive and Dickens Drive would be more suitable for these and will be extended in ensuing years.

Perimeter Fence.—In continuation of the restoration of the iron-picket-and-stone perimeter fence of Centennial Park, a further section has been completed. This is from the Darley Road-York Road junction along the southeastern boundary to the Govett Street gates (easterly exit of Parkes Drive). Cleaning down, rust-proofing and painting of the iron pickets, and cement restoration of damaged stonework, comprised the work.

Miscellaneous.—Centennial Park Superintendent Mr R. Salkeld gave a talk to Bondi Rotary Club on the history of Centennial Park, and recent developments. The Club, greatly interested in the Park's restoration and development, has presented barbecue units for visitors' use. Eastern Suburbs Dog-Training Club has also presented a barbecue unit. The barbecues have been set-up on grassed areas near Ponds 1 and 2. Centennial Park staff provide cut wood and the public is making good use of each unit.

Permission has been given on a number of occasions to film television advertisement and other items. This year a number of sites in Centennial Park were used for the Australian-produced film "It Takes All Kinds" which is in world-wide distribution. Landscape views of the Park are shown to advantage several times in the film.

Effective ranger-control throughout Centennial and Queens Parks has been hindered by sickness or resignations of Departmental Rangers. Consequent arrangement with the Police Department, for members of the Police Mounted Squad to patrol both areas, has restored adequate supervision and been greatly appreciated by the Department of Agriculture.

Centennial Park staff have installed concrete drainage in the *Melaleuca quinquenervia* ("Large-leaved Paperbark Tea Tree") plantation bordering the western side of Parkes Drive from the Oxford Street gates to the Grand Drive. The drained area will thus become a suitable site for picnickers.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

General

STAFF

Changes have been made in the Division's professional staff establishment, towards strengthening the expanding research and extension services and also to provide more incentive for experienced agricultural economists to remain in this Department's service. Very heavy staff-turnover in recent years has seriously inhibited development of extension services in farm management. With a view to the needed greater stability in the professional establishment, through incentive, some of the positions have been reclassified, viz., Principal Research Economist, Principal Extension Economist, and Special Economist (Crop Forecasting).

One Economics Research Officer has been on secondment to the Consultant and Research Division of the Public Service Board throughout the year. Three others have been on study leave for much of the year, at Australian or overseas universities, for formal studies towards the Doctor of Philosophy degree.

Two Economics Research Officers were awarded a Master degree this year. At 30th June, 1969, seven officers were candidates for a Master degree, two for a post-graduate Diploma in Agricultural Economics and another for a post-graduate Diploma in Education.

The Division's recruiting programme is now based mainly on the University trainee system. At 30th June, 1969, there were twenty such trainees in agricultural economics, three of whom were allocated to other parts of the Department.

Research

A series of Research Liaison Workshops has been inaugurated to help increase the effectiveness of the Department's research programme. Two such workshops were held this year. The objectives are greater understanding and appreciation among the scientists, of the agricultural economists' potential role in design and interpretation of experiments—towards ensuring that results are economically useful and will provide maximum data for use in farm management planning.

The Division's own research programme expanded. Five major studies were completed and eight new projects were started. Twenty-three projects inaugurated earlier were continued and interim results for some of these were published. Four projects were discontinued due either to resignation of the officers concerned or to other unforeseen difficulties.

Details of major projects are as follow, classified by subject matter.

1. ECONOMICS OF PRODUCTION

(i) General

Capital Accumulation Among Beginning Farmers.—This project is designed to yield information on the problems of establishment and capital accumulation of soldier-settler farms. Data have been obtained on the survey farms for upwards of 15 years. The data will be processed to derive an investment function, relating the level of investment to a complex of relevant factors. A report is to be prepared.

Survey of Pasture Problems on North West Slopes.—This project was referred to in last year's Report. It is a modification of a larger one originally designed to elicit the major economic problems in the whole Northern Region. Now it is confined to ascertaining the problems in pasture development only in the Ashford Shire. Data from the survey are now being processed. A report will be available shortly.

Enterprise Gross Margins for North Western N.S.W.—Data are being collected by survey. Most of the sample farms have now been surveyed. Gross margins, fixed and variable costs and current management practices are being derived for all crop and livestock possibilities in the region—including dryland and irrigated enterprises. Preparation of the survey results for publications comprises most of the remaining work.

Economics of Soil Erosion Control.—This project was referred to in last year's Report but has been modified because of transfer of the research officer. Whereas it originally entailed three separate sections, attention is now confined to use of the Universal Soil Loss equation under N.S.W. conditions. A paper on this aspect is in preparation.

Machinery Ownership, Operation and Replacement.—This study, subject of a paragraph in the previous Report, continued in the area of machinery ownership and replacement but has had to be abandoned because of inadequacies in the data obtainable from farmers.

Farm Management Accounting in Practice.—The officer originally responsible has resigned and the project has been modified. Further work will involve construction of a production records system for inclusion in the Farm Record Book created by the Division. An analysis system will be developed later, as a further addition to the Farm Record Book.

(ii) Dairy Farming

Whole Farm Studies: Far North Coast.—These are designed to test the commercial potential of the "feed-year" farming system, by applying research findings to eight case-study farms.

The economic analysis comprises year-by-year partial budgets of costs and returns. A detailed report has been prepared on the three red soil farms so far.

A Departmental workshop this year discussed the progress results. Field days were held in April, 1969. A condensed report has been prepared for distribution.

A further report on the three red-soil farms is expected late in 1969 and a summary of the eight farms early in 1970.

Optimum Feed-Year Programmes, North Coast.—Single and multi-period linear programming models are being developed for optimal feed-year planning taking account of the increasing range of tropical and temperate pasture and forage crop species available on the North Coast. Other factors being considered are nitrogen fertilizers, grazing patterns, purchased fodder, cow yield levels, calving patterns and herd size.

Progress has been slower than was anticipated last year but the major part of the study should be completed by the end of 1969-70.

Farm Development Plans, North Coast Dairy Farms.—This project is an extension of the previous study. The aim is to produce optimum development plans for dairy farmers undertaking a feed-year programme. Using multistage programming, it will take account of the restrictions imposed on development by capital and other resource limitations. Progress is dependent on completion of the previous study.

Factors Impeding Adjustment on Far North Coast Low Income Farms.—Identification of the factors impeding adjustments needed to raise farm incomes is the objective. Production function and cost function analysis have been used to develop an explanation of the present pattern of adjustment in dairying. Changes in aggregate supply and demand for dairy products necessitating this adjustment have been examined for their influence. Rates of technological change in New South Wales and Victoria have been compared.

To determine and modify the impediments to resource adjustment requires an understanding of the process whereby farming structure changes. The multitude of factors, many non-economic, which influence this process have been studied. A report on this project is expected before the end of 1969.

Evaluation of Farm Feed-Year Assistance Scheme, Far North Coast.—The farm feed-year assistance scheme has operated on the North Coast since 1966. This study is aimed at an evaluation. Farmers supplying to the butter factory will be surveyed, for information about the scheme's effects on economic and sociological structure of the industry. Some survey delays have occurred but a classified sampling base of 1500 farms should soon be completed.

Economics of the Mastitis Control Programme.—A Departmental programme to control mastitis is being undertaken on fifteen dairy farms, throughout the State. Part of the programme provides for study of the economics of mastitis control. This study will continue through the remaining 3 years of the programme.

Economics of Drought and Supplementary Feeding of Dairy Cattle.—In response to the needs of dairy farmers in the Bega district during the recent drought, simple management guidelines to assist the extension of best management strategies in drought feeding are being investigated. One paper has already been prepared. Complete results of the study should be available by the end of 1969.

(iii) Irrigation

Richmond Valley Pilot Irrigation Projects.—The use of irrigation on dairy farms in the Richmond Valley is being evaluated. Physical and financial records since 1965 have been obtained for the farms. The recordings are continuing. An interim report on the financial results of the four farms has been prepared.

Alternative Farm Enterprises with Irrigation: Darling River System.—Main purpose of this economic study is to provide, by means of budgets, planning data for individual farmers considering private irrigation development in the Darling River system. Emphasis is on intensive cropping. Preliminary budgets have now been compiled for the major farm enterprises. Their publication is planned for 1969. They present physical production details along with enterprise costs and gross margins, together with net farm income, asset structure and capital costs of development.

Economics of Flood Mitigation: Lower Hunter.—This project has been re-commenced, on data becoming available. Attention is currently directed to overcoming the difficulties being experienced in formulating a suitable assessment model for computer application.

Demand for Water in Cotton Production.—Problems involved in pricing public water supplies are being studied. Effect of pricing-policy on efficiency of water use is being analysed. A major review of the literature on pricing-policy for public utilities is involved. A report is in preparation.

Income Uncertainty of Irrigation Vegetable Production.—Information for benefit-cost estimates of proposed State water projects, and information for extension purposes in areas where vegetable production may be introduced or expanded under irrigation are the objectives. Enterprise budgets are being prepared prior to a programming analysis. Publication of the results is planned for 1969.

Coleambally Economic Study.—This project has been completed. The results have been published as a Miscellaneous Bulletin. The Bulletin presents a number of interesting relationships between: income; capital; cash balances; growth in assets, liabilities and net worth; investment and net returns to capital and management and net worth. Data for these categories separately are also presented.

Moirra Irrigation Scheme and Farm Management Study.—A paper on these projects has been prepared for publication in the *Review of Marketing and Agricultural Economics*. The general conclusion so far as the individual farmer is concerned was that dairyfarming was the most profitable enterprise on irrigated farms.

Coleambally Irrigation Area Cost Benefit Study.—Assessment of likely benefits to the nation, of past and future developments of the Coleambally Irrigation Area, is the purpose. Alternatives in the organization and development of the area are to be considered. Inferences are to be drawn, for future planning of other water resource development projects.

Records from twenty-two farms in Coleambally have been analysed and a farm development programme has been devised. A linear programming study of a large area farm has been completed under various conditions, giving optimal farm programmes. On these two bases, a confidence range for gross benefits to the nation has been constructed.

(iv) Horticulture

Banana Farm Management Study.—This is to identify the farm management problems in banana production, and to provide information on the directions for improved farm organization. It is also designed to suggest avenues for further research. A preliminary report has been prepared.

Prune Industry Study.—This has involved the collection of input-output data on physical and financial aspects of prune production at Young and Griffith, N.S.W. Seven growers were interviewed. The resultant financial data are being collated and gross margins and net disposable income will be calculated. A report is in preparation.

(v) Beef

Beef Cattle Industry, Especially in Northern N.S.W.—This project, referred to in last year's Report, has been financed by the Australian Meat Research Committee. There are two facets. The first involves a case-study to examine the possibilities for building-up cattle numbers during a pasture improvement programme in the Clarence Valley. Dynamic linear programming is being used. The project is approaching completion.

The second is a survey of the factors involved in superphosphate usage in the area. Attention has been on the relation between the "trial" and "adoption" stages of the introduction of superphosphate. The study is complete. A paper is to be published in the *Review of Marketing and Agricultural Economics*.

The study found that in those farmers at trial stage the transition from trial to adoption can be discerned. Continuous progression over time is apparent. As the new practice becomes more widely known the initial area fertilized increases, and as this increases the change from trial to adoption quickens.

Decision Making by Beef Cattle Producers: Clarence Valley.—This study is to investigate major aspects of decision making by beef cattle producers in the Clarence River Basin, to understand better their goals and problems. Exploratory work is to provide a base for further research. All aspects of major decisions taken by beef producers are to be studied and the rationale for choices made will be analysed. The study involves a survey to begin in early 1970.

(vi) Mutton and Lamb

Regional Studies of Mutton and Lamb Production.—This work has been financed by the Australian Meat Research Committee. The two areas of study are marketing problems and production problems.

A number of important marketing aspects have been investigated. Price movements at auction for lambs, wethers, hoggets and ewes have been analysed; the series separated into seasonal, cyclical and trend components. Results of this work could be of use for predictions.

Reasons for the recent low prices for lambs have been studied, including the influence of lamb imports from New Zealand. Likely effects of introduction of a carcass grading scheme have also been studied.

A final report on each aspect is being compiled.

(vii) Poultry

Chicken Meat Production in N.S.W.—This continuing project has progressed substantially. Of the 142 broiler growing farmers interviewed for financial and management data, sixty-one suited the purposes of the study. A preliminary report on the financial situation of broiler growing farms for the 1967–68 financial year was released in November, 1968. Detailed computer analysis of the data is proceeding.

A Miscellaneous Bulletin on the general management and economic structure of broiler growing enterprises is being prepared. The study will continue, with further investigation of factors affecting broiler industry profitability.

2. MARKETING AND POLICY RESEARCH

(i) Commodity Investigations

These continuing studies provide up-to-date and readily available information on the current position, trends and prospects of agricultural commodities. The attention initially being given to relatively minor crops will be extended later. There are three aspects:

- (i) Size and nature of market and of production;
- (ii) Analysis of present trends in demand and supply;
- (iii) Prediction of future developments under existing policy and possible changes in policy.

Current investigations involve vegetable oils and oil-seeds, and coarse grains. There will be reports on these during 1969.

(ii) Decision Making Information in the Marketing System

In traditional approaches to decision-making, the need of up-to-date assessment of market trends has been too little satisfied. This investigation is an attempt to incorporate information for satisfaction of this need, with existing theory. It is extremely relevant to an assessment of the kind of information, actual or potential, supplied by government to farmers. It is basic also to a consideration of the introduction of grading schemes.

(iii) Study of "The Cobweb Cycle"

The purpose of this study is to extend the models of cyclical price movements currently in use, to take account of shifts in supply and demand. Price cycles exist for a number of commodities, and this study will help to interpret them more precisely. A report is in preparation.

(iv) Domestic Demand Structure for Shell Eggs

Work on this project, described in previous annual reports, has again been delayed—by the urgency of another project of the research officer concerned. The study is expected to be resumed shortly.

3. RESEARCH METHODOLOGY

The two projects, *Method Studies in Dynamic Models of Production Computer Programming and Experimental and Statistical Method in Response Surface Estimation*, have now been discontinued due to resignation of the officers responsible.

Advisory, Educational and Extension Activities

PUBLICATIONS

The Review of Marketing and Agricultural Economics

The March 1969 issue of this quarterly journal included publication of the first commissioned review paper by agricultural economists of international standing—"The Theory of Spatial Equilibrium and Optimal Location in Agriculture: A Survey", by G. Weinschenck, W. Henrichsmeyer and F. Aldinger, each a distinguished West German agricultural economist.

The policy of publishing major review papers by overseas agricultural economists of the highest professional standing will continue. It is an important service to agricultural economists throughout the world and at the same time will enhance the standing of the *Review*.

Bulletin and Leaflet Series

Miscellaneous Bulletin Series.—This series was introduced in the preceding year. Four such bulletins were issued this year. Another bulletin was in press at 30th June and copy for two more is in hand for publication later in 1969. The Bulletin series has been very well received and is usefully disseminating detailed data on various economic aspects of agriculture.

Farm Planning Series of Leaflets.—This series was continued but with reduced output. Considerable expansion of the series during 1969–70 is intended. Ultimately each of the nine agricultural regions should be producing Farm Planning Leaflets. The leaflets are designed particularly for the use of farmers in the region wherein they are published.

Miscellaneous Periodicals

"*Getting Started in Farming in N.S.W.*"—The demand for this popular pamphlet has been very heavy and has necessitated republication in processed form. Copy has been prepared for a new printed edition.

Weekly Marketing Notes.—This and other publications (see later; under 'Marketing Reports and Related Services') giving information on prices of rural produce sold at the various Sydney wholesale markets were continued.

"*Contract Rates for Various Farm Operations in N.S.W.*"—This processed publication was completely revised and the format improved. Demand for it has been very heavy, necessitating a substantial reproduction. The revised edition was issued in September, 1968.

EXTENSION SERVICES IN FARM MANAGEMENT

Provision of schools and courses in farm management economics has become an increasingly important Divisional function. Demand for them remains greater than existing staff numbers can handle. The Division organized nine such schools this year; two were of 1 week duration (residential)—one for farmers, the other for in-service personnel; two were of 3 days; three of 2 days; one was spread over 4 evenings; and the other was a half-day school.

Officers of the Division of Marketing and Agricultural Economics also provided forty-five separate lectures at schools and conferences run by other organizations. Eight television segments and twenty-one radio broadcasts also were provided by officers of this Division; on topics related to their work programmes.

Provision of advice requested by the public on specific problems has increased, reflecting in part the increase in number of economists stationed at country centres. Problems handled by the officers ranged widely, e.g., property purchase, record keeping, relative profitability of alternative enterprises, sources and use of credit, costs of equipment, advisability of leaving farming. The type of service in response to these inquiries also varied greatly, e.g., from a few minute discussion, to detailed written statements setting out plans for a number of years ahead.

The greater number of officers of the Division at country addresses has also allowed increased general support to the extension and research officers of other Divisions of the Department. General and specific assistance to the agricultural servicing industry (the banks, pastoral houses, fertilizer firms etc.) have also increased.

Another activity expected to play an increasing role in the Division's farm management extension work was established late this year—a group farm record analysis scheme. A pilot group was formed at Inverell, with the local District agronomist in an important role. Another group was formed at Wagga. A third is forming at Gunnedah. Computer services of the Farm Management Service Centre at the University of New England are to be utilized to give farmers in a group a detailed analysis of their farm activities.

UNIVERSITY AND COLLEGE LECTURING

At Universities.—Three officers of the Division continued to give part-time courses in agricultural economics to students at the University of Sydney and the University of New South Wales during the latter half of 1968.

At Agricultural Colleges.—The Division continued to provide full-time lecturers in agricultural economics and farm management at Wagga Agricultural College and Yanco Agricultural College. It also provided substantial part-time assistance in these subjects at Hawkesbury Agricultural College, from the start of the second term of 1969. This is temporary assistance pending appointment of a second full-time lecturer in agricultural economics at Hawkesbury Agricultural College.

POLICY ADVICE

The Division has been increasingly called on for advice on economic policy affecting agriculture, with particular reference to such marketing matters as the wheat stabilization plan and the wheat quota scheme. The Division continued to examine and advise on the position in respect to imports and exports of coarse grains and other feedstuffs.

Marketing Reports and Related Services

Reporting.—The Division fulfilled a statutory function relative to the Marketing of Primary Products Act, 1927–1965, by continuing to collect and disseminate detailed wholesale market information.

Reports covering supplies, quality, price and price movements, at the City Municipal Markets (fruit, vegetables, poultry, fish, and cut flowers), at Homebush (cattle, sheep and pigs), at Alexandria, Perry Park, and Sussex Street (grain, forage and hard vegetables) were provided each day the various markets traded.

Press and Radio Daily Service.—Market information provided by the Division was broadcast daily by the Australian Broadcasting Commission, including regional relays and interstate hook-ups, and by some commercial radio stations. The daily press, periodicals, Federal and State government departments and instrumentalities, producer organizations, etc., were furnished with detailed marketing information through the *Daily Wholesale Price Quotations*.

Monthly Surveys.—Monthly surveys of wholesale and retail stock-feed prices and wholesale prices of dressed poultry were continued.

Inter- and Intra-State Supply Trends.—Records of arrivals into Sydney by rail and sea, of various primary products from inter- and intra-State sources, were maintained.

General Information Service.—Numerous requests were received from State and Federal government departments, banks, and private individuals (in Australia and overseas) for information about prices and prospective markets for an extensive range of primary products.

Crop Reviews and Forecasts.—These services continued. Production forecasts were prepared for wheat, oats, citrus fruits, and broom millet.

The regular monthly survey of *New South Wales Pastoral Conditions* and the *Report on Production Trends* continued to be published. As already indicated, the publication of *Weekly Marketing Notes* continued unchanged.

Representation on Committees

The Chief of the Division of Marketing and Agricultural Economics continued as N.S.W. Government representative on the Australian Tobacco Board, with the Deputy Chief as alternate member.

The Chief was a member also of the Tobacco Industry Leaf Finance Agency, a member of the Department of Local Government Committee of Enquiry into the establishment of new wholesale fruit and vegetable markets at Newcastle, and of the Department of Decentralisation and Development Committee of Enquiry into the establishment of wholesale fruit and vegetable markets at Wollongong.

The Chief of the Division was appointed Commissioner under the Local Government Act to conduct a public inquiry into the location of the Orange Stock Sales Yards. As yet there have been only preliminary hearings.

The Deputy Chief of the Division continued as Chairman of the Yass Valley Technical Advisory Committee until this Committee disbanded early in 1969. One of the Economics Research Officers was Secretary.

The Deputy Chief continued as Chairman of the Committee to Examine the Effects of Devaluation on the Primary Export Industries; also as Executive Officer of the State F.A.O. Committee. He was appointed to the Advisory Committee for the Diploma in Agricultural Courses—Business and Social Studies, and to the Board of Studies. He and one of the Economics Research Officers were members also of the New South Wales Poultry Advisory Board Sub-Committee on Egg Production.

DIVISION OF INFORMATION SERVICES

Functions

The Division provides:

- Editing Services
- Research Liaison (Science Writing) Services
- Enquiry Counter and Publications Distribution Services
- Home Garden Advisory Services (by secondment from Division of Plant Industry)
- Library Services
- Assistance in Extension Principles/Methods study courses

Sectional Reports

EDITING SECTION

Advisory Bulletins

There are now 1,363 titles in the range of numbered bulletins; comparable with the 1,364 of a year ago, and notably more than the 1,219 of 2 years ago.

The Editing Section sent 173 jobs to the printery, as against 248 in 1967–68 and an average of 216 per year for the 6 years to 1967–68. The printery delivered 200 publications, as against 269 in 1967–68 and 323 in 1966–67.

Some 323 publications needing subject-matter revision and/or editing attention prior to submission to the printery comprise the hard-core backlog of work in the Editing Section. A year earlier there were 296 in this category. In the 323 are 58 already revised by authors but awaiting editing attention, 158 in author hands for revision, and 107 held by the Editing Section for subsequent submission to authors. Submission to the authors for subject-matter revision at this time would be premature according to the author Divisions' priority listings.

Press Releases

Ninety press releases were handled, as against fifty-nine in the previous year. Most were Ministerial.

Miscellaneous Periodicals

Dairy Topics.—Five in lieu of six issues of this 2-monthly periodical were delivered. The May/June, 1969, issue was overdue from the printery at 30th June, 1969.

The five issues averaged 23 pages and 8.6 articles, compared with 22.5 and 7 in 1967–68. Of the 43 articles in the 5 issues: 24 originated in Division of Dairying, 1 in Animal Industry, 5 in Information Services, 4 in Plant Industry, 2 in Marketing and Agricultural Economics, 1 in Science Services, 1 in the Research Stations Branch, and 5 came from sources outside the Department.

Poultry Notes.—Four issues of this quarterly periodical were delivered, the final one on 23rd May, 1969.

Veterinary Notes.—Only three in lieu of four issues were submitted to the printer this year. The September and December, 1968 issues were combined at the request of Division of Animal Industry. June issue, final for the year, was delivered by the printery on 2nd June, 1969.

The Agricultural Gazette of N.S.W. (monthly)

Twelve issues of this monthly periodical were delivered, the latest in June, 1969. Ten of the twelve appeared in the nominal month of issue. The most notable delay was for the July, 1968, issue, received on 6th August instead of on the scheduled 17th July.

The Gazette's *Research Section* averaged 7 pages per issue, as in the previous 3 years. *Research Pars* in this Section averaged 4.5 per issue, compared to 3.7 per issue in 1967-68 and 3.8 in 1966-67. Also, 7 research papers or articles appeared in this Section of the Gazette, compared to 10 in 1967-68 and 9 in 1966-67. Research officers are encouraged to publish their research papers in external science journals rather than in the Gazette.

Gazette mailing list additions and deletions resulted in a net gain of 2,253 this year; compared to 3,017 in 1967-68, 1,992 in 1966-67 and 1,800 in 1965-66. The mailing list now requires a printing of 25,000 Gazettes per issue.

Text Books/Farmer Handbooks

"Weeds" Book (J. N. Whittet).—"Weeds", 2nd Edition (4,965 copies) came into stock, at \$4.20 per copy, on 18th November, 1968, and a substantial part of the Edition has already been sold (see later note).

"Pastures" Book (J. N. Whittet).—"Pastures", 2nd Edition, is at an advanced stage of production. Text for the Edition went to the printery in February, 1968, and corrected final proofs are now at the printery for press. Index copy is at the printery and proofs are awaited.

"Trees of N.S.W." Book (R. H. Anderson).—The 4th Edition came into stock on 15th August, 1968, at \$6.30 per copy.

RESEARCH LIAISON (SCIENCE PUBLICATIONS) SERVICE

In preceding notes, about the *Agricultural Gazette of N.S.W.*, there is a quantitative account of research *Pars* and research papers or articles published in the Gazette: in effect, fifty-four research *Pars* and seven research articles or papers during the 12 months. Most of these came to the Gazette staff from research workers through their senior officers in the Division concerned. This flow sustained the Research Section of the Gazette whilst the Research Liaison Officer recruited in 1968 was undergoing in-service training and intensified experience of science editing by 6 months secondment to the *Journal of Experimental Agriculture and Animal Husbandry* production office in Melbourne.

A second Research Liaison Officer position was established, and has been occupied from 30th April, 1969. This officer is stationed at Rydalmere, specifically for science-writing assistance to the Division of Science Services.

ENQUIRY COUNTER AND PUBLICATIONS DISTRIBUTION SECTION

Enquiries Serviced.—Excluding the Home Gardens Enquiry Officer (H.G.E.O.) work reported in later paragraphs, the Enquiry Counter office assistants (two) handled 36,525 requests; compared with 32,365 in 1967-68 (first year in the State Office Block) and 42,197 in 1966-67 (whilst at the longstanding Farrer Place site).

Of the 36,525 requests serviced: 12,021 were telephoned, compared with 10,705 in 1967-68, 8,673 in 1966-67, and 8,433 in 1965-66; 8,206 were postal, compared with 6,355 in 1967-68, 14,966 in 1966-67, and 16,043 in 1965-66; and 16,298 were in-person at the enquiry counter, compared with 15,305 in 1967-68, 18,523 in 1966-67, and 17,825 in 1965-66.

Of the 8,206 postal enquiries, 2,499 were from urban and 5,707 from rural addresses.

Publications Distribution.—The Enquiry Counter office assistants and the clerical assistant (formerly "attendant") dispersed 754,562 items of literature; compared with 871,203 in 1967-68, 829,025 in 1966-67, and 760,699 in 1965-66.

Their total of 754,562 for 1968-69 included 139,883 direct to members of the public by post or in-person; 559,677 in bulk-parcelled responses to requests from Regional/District offices and the Colleges; and 55,002 in applying the "New/Revised/Reprints" mailing list—to inform country offices in respect of material recently received from the printery and to satisfy the libraries of various institutions in this and other countries.

SALES OF PUBLICATIONS

Revenue from this Division's sales of publications approximated \$9,622, as against about \$2,600 in 1967-68, \$8,736 in 1966-67, and \$8,000 in 1965-66. A major reason for the 1968-69 total was the availability of "Weeds" 2nd Edition at \$4.20, helped also by availability of "Trees of N.S.W." 4th Edition at \$6.30 and "The Home Vegetable Garden" 5th Edition (50c).

"Weeds" 2nd Edition (4,965 copies) came into stock on 18th November, 1968, and 2,371 have been dispersed from this Division: 2,057 by sales either to individuals at full price or to bookshops, colleges, local Councils at discount rates; and 314 to Regional offices for their local sales. Additionally, the Government Printer has drawn 180 copies for direct sales. Thus, slightly more than half of the 2nd Edition stock has been disposed of in 7½ months. Sales of "Weeds" account for some \$7,212 of this Division's total of \$9,622 from sales of publications.

The other \$2,410 from sales included roundly \$972 from Farm Record Books (and component parts) and roundly \$1,438 from other items—notably "Trees of N.S.W.", available from 15th August, 1968 (20 copies sold at \$6.30 and 139 at discount prices) and "Home Vegetable Garden" (50c) available from 21st February, 1969 (347 copies sold).

HOME GARDENS ADVISORY SERVICE

Individual Contacts.—Dealing with home garden, allied and commercial floricultural enquiries of the type that office assistants in the Enquiry Section would be unable to service, the Gardens Enquiry Officer handled 8,066 requests; compared to 5,708 in 1967-68, 6,886 in 1966-67 and 5,881 in 1965-66.

In the 1968-69 total there were 5,038 by telephone, 1,224 postals, 1,729 in-person at the Enquiry Counter, and 75 from field officers. A notable increase was in the number of telephoned enquiries handled; an increase from 2,702 in 1967-68 to 5,038 in 1968-69. This was achieved only by shortening enquirers' conversation whenever possible; risky in terms of public relations, and sometimes risky also in terms of data needed for the diagnosis. When the approved second Gardens Advisory Officer position is filled these undesired circumstances will be alleviated.

Lectures and Field Activities.—Nine evening lectures to Horticultural Societies/Gardens Clubs in the metropolitan area were given by the Home Gardens Officer in his own time, and day lectures were provided at two rural gatherings—the Blue Mountains Beautification and Garden Group, at Springwood, and the West Trundle and Mordialloc Branches of the Agriculture Bureau, at Trundle.

Inspections and advice were provided by him for Merrylands High School (the playing fields), the Phoenix Kindergarten at Balmain (the lawns) and the Oatley Flora and Fauna Society (the native garden). A 2-days symposium on "Growing Plants for Profit", at the Division of Science Services, Rydalmere, was attended by him. The symposium was jointly organized by the N.S.W. Nurserymen's Association and this Department.

Literature and Radio.—The Home Gardens Officer published articles on dahlias, fuschias and sweet peas in the *Agricultural Gazette*. He also provided two 6-minute tape recordings for the Australian Broadcasting Commission's broadcast responses to children's horticultural enquiries.

LIBRARY SERVICES

General

Central Library Relationship to State Office Block (S.O.B.)—The position of Librarian-in-Charge, Agriculture, is synonymous with that of Librarian-in-Charge (S.O.B.); the latter

embracing the library services of six Departments—Agriculture, Local Government, Mines, Public Works, Premier's and Treasury. It is estimated that just on roundly 80 per cent of the funds to which the Librarian-in-Charge (S.O.B.) has access are from Agriculture, so roundly 80 per cent of the work force (fifteen professionals—including the five librarians at decentralized institutions of the Department of Agriculture and five clerical) is occupied by library services for Agriculture.

Branch Library Visits.—The Librarian-in-Charge (new to the position in May, 1968) this year inspected the branch library at Yanco Agricultural College and Research Station and, reflecting urgent needs, raised a further submission for Public Service Board establishment of a librarian position there.

Branch libraries at Hawkesbury Agricultural College and Wagga Agricultural College also were inspected, and consequent recommendations were made for appointment of additional staff to each. Leeton Agricultural Research Station, Leeton Regional office, Griffith Viticultural Research Station, Griffith District office, Seven Hills Poultry Research Station and the Royal Botanic Gardens/National Herbarium branch libraries were also inspected by the Librarian-in-Charge.

Including the three Agricultural Colleges' branch libraries (four when "Tocal" is formally taken over by the Department during 1969-70), the eighteen Research Institutions'/Stations' branch libraries, the various Divisional and the nine regional Headquarters branch libraries, and the numerous district offices' Reference Book Collections, there are roundly ninety-two branch libraries/book collections served in roundly 100 days by the Librarian-in-Charge and staff, Central Library. The servicing includes all ordering; all funds expenditure.

Funds for Books, Periodicals, Papers

This year the Librarian-in-Charge had access to and expended for Agriculture roundly \$41,000. The total comprised: \$15,800 in the Consolidated Revenue (C.R.) B4 vote (as against \$14,000 in the previous year); \$18,000 from the Commonwealth Extension Services Grant (C.E.S.G.); \$3,985 for Hawkesbury College, in the form of \$2,725 from the Students' Trust Account and \$1,260 from a Commonwealth grant for educational purposes; \$2,300 for Wagga Agricultural College, in the form of \$1,300 from the Students' Trust account and \$1,000 from a Commonwealth grant for educational purposes; \$950 for Yanco Agricultural College, from the Students' Trust Account; and sundry other smaller amounts for specific purposes.

Of the \$15,800 from C.R. funds, roundly \$11,500 is now required to meet standing commitments for periodicals. Because of the narrowing margin no new periodical subscription was placed against the C.R. fund this year. Meantime this year the library staff compiled a listing of all periodicals now received by the Department and a respective listing of the periodicals received into each branch library or country office. One outcome of these listings will be, during 1969-70, some rationalizations—involving cancellation of some subscriptions and the placement of some new subscriptions in light of funds so saved.

Some new subscriptions to periodicals were placed this year for country research and extension personnel, as a charge against the C.E.S.G. money. Importantly the C.E.S.G. money provided also additional reference material for ninety-two country centres.

Orders, Accessions, Loans

Order Statistics.—Some 2,800 new items were ordered, or covered by requisitions, through local booksellers or the N.S.W. Government Offices in London. Of the total: 535 were for Hawkesbury Agricultural College, 536 for Wagga Agricultural College and 131 for Yanco Agricultural College.

Meantime for other Departments in the S.O.B. complex, the Library staff ordered 133 items for Public Works Department, 70 for Mines Department, 13 for Local Government and 23 for Premier's Department.

Central Library Accessions.—The total was 26,971 items, as against 31,481 in 1967-68. In the 26,971 were: 2,110 books, 19,123 new issues of periodicals, 943 annuals and 4,795 pamphlets. The 4,795 pamphlets comprised 2,871 in series, 693 catalogued, 480 distributed by subject, and 751 miscellaneous. Average-per-week rate of accessioning was 519 items.

Central Library Loans.—Loans totalled 37,021 as against 45,454 in 1967-68. In the loans were 25,727 loans of periodicals (an average of 495 per week), circulated in accordance with standing lists of borrowers, and 11,294 miscellaneous loans (an average of 217 per week).

Of the 11,294 miscellaneous loans it is of interest that, whilst 9,457 were to Departmental officers, 1,387 were to libraries of other institutions. Reciprocally, 450 were borrowed from such external libraries.



Co-operative Forage-Comparison Trials; Central Tablelands

Oberon Graziers Association, and the Department's District Sheep and Wool Officer (Orange) and District Agronomist (Bathurst) are co-operating in forage crop and perennial pasture comparison trials, for production and for ability to finish lambs for market.



Forage to Finish Prime Lambs for Market

The 2 years of the co-operatively promoted forage-comparison trials at Oberon have underlined the value of rape in carrying and finishing lambs for market.

Branch Libraries' Loans.—It has not been possible to collate a near-to-complete figure for loans from branch libraries and decentralized book collections to indicate the degree of usage of reference sources by officers at the various places. However, there is a known total of 25,552 loans for the following branch libraries: Division of Science Services (11,135), Hawkesbury Agricultural College (4,662), Royal Botanic Gardens and National Herbarium (1,530), Glenfield Veterinary Research Station (6,962), Wagga Agricultural Research Institute (320) and Wagga Agricultural College (943). Those named here are the only places where a professional librarian is stationed; hence the statistics.

New Exchanges Arranged

Exchanges were arranged for agricultural literature from various institutions in India, Japan, Malaysia, The Netherlands, New Zealand, Peru, Romania, Tunisia and U.S.S.R.; reciprocal for the *Agricultural Gazette of N.S.W.* and/or *Review of Marketing and Agricultural Economics* and/or the *Annual Report* of the Department of Agriculture.

Other Library Services

Library Information Bulletins.—Ten Information Bulletins were compiled by Central Library staff this year and distributed widespread. These totalled 483 pages and included 4,839 items about recent accessions, as against twelve Bulletins in 1967–68 totalling 505 pages and 5,286 items.

Reference Literature Searches.—Bibliographies produced by literature searches undertaken for specific enquirers (research and extension personnel) were also permanently carded for possible on-call use by other officers and were listed (by search title) in the distributed Library Information Bulletins. This year sixty-one such searches were listed, the same total as in 1967–68.

Photocopying Service.—The 1,131 photocopying jobs, done for the Library by the S.O.B. Document Reproduction Centre, comprised 11,139 sheets, as against 947 jobs, 7,639 sheets, in 1967–68.

Translation Service.—Twenty-eight translations (variously from Dutch, French, German, Italian, Japanese, Russian, and Swedish language) were supplied for Departmental officers.

ASSISTANCE IN EXTENSION SERVICE STUDY COURSES

The Chief of Division of Information Services organized and participated in, by invitation from the University of Sydney School of Agriculture, a one-week school on Extension Service Principles/Methods for 2nd year undergraduates, and a more advanced course of lectures and tutorials for a special group of the 4th year undergraduates.

Also, by invitation from the Commonwealth Department of External Affairs, he provided some of the foundation sessions in the 10 weeks' course on Extension Principles/Methods for personnel from Asian, African, and South West Pacific countries.

DIVISION OF EXTENSION SERVICES

General

SOME NEW DEVELOPMENTS

Extension Research and Evaluation Section

Establishment of a section for extension research and evaluation studies has been approved. Appointment of a Principal Extension Officer (Research/Evaluation) is expected to occur early in 1969–70 and the service should be functioning soon thereafter.

The extension research and evaluation studies will aim to indicate the efficiencies of methods relative to local situations and needs, compare and relate the various extension methods within the extension/adoption process, assess extension programmes, work plans and suggest changes of direction or emphasis of methods.

Regional "Extension Specialist" Positions

The first Regional extension specialist position has been approved. An appointment will be made shortly. The appointee, with status of Assistant Principal Extension Officer, will be stationed at Northern Region headquarters, Tamworth, to service the Northern and North Western Regions.

His main developmental responsibilities will include: officers' extension programming and co-ordinated use of extension resources, local extension evaluation studies, group-extension agencies, officers' skills in extension, and extension/research liaison.

Extension Programming, and Work Plans

Within this Report of the Department the various subject-matter Divisions have incorporated some of the evidence of the beneficial effects of "programmed objectives" and "work plans" on field personnel and extension efficiency in general.

The policy decision of the Department, early in 1968, in effect obligates each extension worker:— to record a situation statement and analyses; to determine long-term (or "overall") and short-term (or "component") objectives implied by the situation analyses; to identify problems or barriers to be dealt with in order to achieve the selected objective(s); to commit to paper work-plans designed to achieve the set objective(s); to review periodically the progress and methods; and to report annually; the report to include any necessary revision or re-statement of objectives for the forthcoming year.

These procedures have now entered their second "year". In the interim the procedures have been further detailed by the Department's *Extension Policy Committee*—guided by the *Extension Programme Co-ordination Committee*. The extension "programme year", for annual reviewing and reporting and re-statement purposes, has been defined as the 12 months from 1st April to 31st March, inclusive. Also, besides his yearly reporting and possible re-statement of programme during April, the officer is required to present and discuss with his Regional Supervisor in October a 6 months' interim short report (for April to September, inclusive) on his programme and planned activities.

The Regional Supervisors (decentralized senior officers of the Division of Extension Services affecting the individual efficiency and team-work of officers of all other Divisions) obviously have a key-role. They are collaborative reviewers, assessors, and advisers in respect of the programme and work-plan of each of the many field officers of other Divisions in the respective Region. At the same time the Regional Supervisor is a two-way bridge between head office of each subject-matter Division (specialist personnel in particular) and that Division's personnel in the Region. And, not least, the Regional Supervisor is a co-ordinating element—helping to assure the inter-disciplinary teamwork essential for whole-situation extension programmes and activity-plans in his Region.

The Regional Supervisors' 1968–69 reports have affirmed beyond doubt that the system requiring programmed extension objectives and commitment to work-plans has profoundly influenced extension workers and their effectiveness. The reports indicate a more positive approach to extension as a discipline in its own right, more critical examination of barriers to the adoption of innovations, greater co-ordination of the efforts of officers of different disciplines—towards achieving common objectives.

Many of the 1968–69 work-plans lacked sufficient detail of commitment to times or places or events and detail of purpose underlying the intended activity. But the experience from this first year of the system has led to notable improvements in the 1969–70 programming of objectives and work-plans. In general, these are more realistic, specific, and purposeful.

Towards simplification of preparation of statements and reports of programmes and work-plans, and of their supervision and assessment, some of the Regions are collaborating to develop suitable forms for officers' use. In due course the outcome of their experience in these respects will be assessed at District, Regional, and Head Office levels.

In most Regions the ultimate and most difficult facet has already been attempted, the close involvement of primary producers and/or their organizations, in the programming of objectives and work-plans. The public relations content of these attempts has been excellent. The desirability of involving the producers in the setting of objectives and fulfilment of work-plans has been abundantly shown. Generally, the farmers' organization in the respective area has agreed with the objectives and plans drafted by the extension service personnel. Some have suggested modifications and these have been acted upon. As each of the "partners" acquires more experience of this "mutual involvement" the relevancy of programmed objectives may be expected to sharpen.

Related to these attempts at "mutual involvement", Regions are surveying the situations as regards existence and distribution of active branches of farmer organizations within their territory. *Inter alia*, the data will reveal possible needs for further groups to be helped into being—as an aid to the Region's group-

extension activities. An example of this type of survey was provided by the Southern Region's Supervisor. Results there showed within the Region seventy-two branches of the United Farmers and Woolgrowers Association, twelve branches of the Graziers Association of N.S.W., six branches of the Agricultural Bureau of N.S.W., and one Fat Stock Producers' Association group. These are well distributed, throughout the Region, on paper, but strength or state of activity of each branch is not yet known.

DEVELOPMENT OF OFFICERS IN AND FOR EXTENSION SERVICE

Practical, Early Experience

In-service development of potential District officers continued in each Region. By this system, the young officer within his first 2 years with the Department is given a minimum of 6 months intensive training in one or more Regions. He is under the guidance of the respective Regional Supervisor and is placed with District personnel of other Divisions as well as with those of his own subject-matter Division. He is given experience in all aspects of extension work and appropriate administrative procedures.

Special Courses

Currently three officers of the Division of Extension Services are improving their qualifications for extension work by part-time courses for the B.A. degree and another is working towards an M.Sc. Three others this year attended a 1-week Audio Visual Aids workshop in Melbourne, organized by the Victorian Department of Agriculture and financed by the Commonwealth Department of Primary Industry. Other officers undertook specialized lines of training or study to increase their competencies.

Overseas Conference, Seminar, Study Tours

The Chief, Division of Extension Services, attended with Directors of Extension from many countries an International Conference on farm management aspects of extension in Paris, organized by the Organization for Economic Co-operation and Development. The Mid Coast and Hunter Regional Supervisor, Mr N. W. Vane, undertook (on C.E.S.G. funds) an overseas study tour including attendance at the Extension Seminar of the International Study Centre, Wageningen, Holland. The South Western Regional Supervisor, Mr E. Tindale, was awarded a Public Service Board Fellowship to study extension methods in U.S.A. and other countries for a period of 4 months.

Extension Service Principles and Methods; Training Schools

The Division again conducted the Department's annual in-service Extension Service/Methods School, at Hawkesbury Agricultural College over 10 days. The school provided training in various aspects of extension principles and methods. It was attended this year by forty officers—including three Rural Youth Organization District Supervisors from Department of Education.

As in previous years, the Division also provided sessions on extension principles and methods for field officers at other schools—promoted by various Divisions and Branches. Also, two officers of this Division assisted the Chief, Division of Information Services, as tutors during a 1-week Extension Principles/Methods School for second year undergraduates in the University of Sydney School of Agriculture.

The Public Service Regulation 124 Higher Grades Examination on Agricultural Extension for Departmental field officers and Rural Youth Organization officers were set and marked by the Division's Assistant Principal Extension Officer (Group Extension).

Regional Services

STAFF; NUMERICAL

At 30th June, 1969, within the nine Regions and under Regional Supervisors administration for advisory, regulatory and allied services there were 453 officers of the various subject-matter Divisions of the Department—and a further forty-eight positions were vacant. Thus the total, including the vacant positions, would be 501—an increase of nineteen by comparison with 12 months earlier.

The Department's personnel at the Research Stations and Agricultural Colleges, and the veterinary personnel, are not in that total. They are separately administered systems. But the total of 501 does include ninety-four officers in clerical and office assistance categories.

REGIONAL ADVISORY COMMITTEES

The Advisory Committees, one per Region, appointed by the Minister to be representative of primary industries and areas within the respective Region, continued their role, offering ideas, recommendations, and comment affecting extension and research. This year the Minister attended an Advisory Committee meeting respectively in North Western, Southern, South Coast and Tablelands, and Western Region.

MASS AND GROUP MEDIA USAGE

Press, radio, and television usage, and purposeful participation with farm organizations in staging formal group activities—schools, courses, and field days, continued to enhance the Department's extension effectiveness and public relations. In the following tabulation a statistical impression of some of the mass and group media usage within the nine Regions is presented:

Region	Publicity statements	Radio programmes	Television sessions	Schools/Courses	Field days
Mid Coast and Hunter	291	776	Nil	11	50
Mid Western	244	654	3	22	54
Northern	197	747	16	13	27
North Coast	335	439	41	8	40
North Western	124	982	12	21	50
South Coast and Tablelands	230	220	20	15	19
	(approx.)				
Southern	224	463	..	14	4
South Western	115	330	52	11	17
Western	250	1,588	Nil	25	38
Total 1968-69	2,010	6,599	144	140	339
Total 1967-68	2,013	5,624	235	206	246

Not included in that tabulation were the several multi-page newspaper supplements and the weekly or fortnightly feature articles prepared by Regional staff.

Similarly, the many meetings of Agricultural Bureau and other farm organization branches attended by field officers for talks, discussion groups, and film or slide screenings have not been included there. The reports of the various subject-matter Divisions include tabulations that attempt a statistical account of those.

REGIONAL FODDER CONSERVATION WORKSHOPS

To clarify thoughts and policy in respect of fodder conservation an intra-Departmental committee instigated a requirement that each Region conduct a workshop whereat all extension officers would participate—with appropriate subject-matter Specialists from various Divisions. Division of Marketing and Agricultural Economics and Division of Extension Services collaborated to construct the directive outlining specific questions to be answered in each Region. The Division of Extension Services convened all committee meetings and co-ordinated the arrangements for the Regional Workshops. Some of the Workshops have been held, but most will be conducted early in 1969-70.

SOME PARTICULAR NOTES FROM REGIONAL SUPERVISORS

Mid Coast and Hunter Region

Total Agricultural College.—Announcement that as from 1st January, 1970, the C. B. Alexander Presbyterian Agricultural College, Tocal, will be a Department of Agriculture institution has special significance for this Region. Proposed development of the College also as a Research Centre offers an answer to an expressed need in the Region.

The Region has no Departmental research institution within its boundaries. Moreover, no other organization—Commonwealth or State—has an agricultural research institution in the Region. The Region's research establishment has until now comprised two Departmental research agronomists; one at Maitland and one at Taree.

Total offers potential for research activities directly relevant to many facets of the regional agriculture and extension service.

Regional Staff Increased.—Staff establishment in Mid Coast and Hunter Region improved considerably. Another District agronomist, a District fruit officer, another District dairy officer—with a herd organizer and four herd recorders as support staff—were added. Also, the District livestock officer (poultry) stationed at Gosford will work in the Region, and a livestock officer (apiculture) will relieve the Tamworth apiculture officer of work in the southern part.

Mid Western Region

Farmers' Successes in Major Competitions.—Awards for high managerial skills shown by farmers in this Region, in State-wide competitions, has been a feature this year. Mr H. Bryant of Cowra won the State-wide Ampol/U.F.W.A. "Farmer of the Year" Competition. A. W. Couchman & Sons, of Condobolin, won the State-wide Beef Cattle Breeders Competition. Walker Bros. of Cowra won the Inland Maize Competition. In the R.A.S. Field Wheat Competitions, Championship awards (in the Tablelands Division, the Riverina Division and the Central Slopes Division) were gained by farmers living in the Cowra, Thudungra, and Parkes Districts of Mid Western Region.

Regional Staff Increased.—A District livestock officer (pigs) has been appointed, located at Parkes. Also there is now a seed production officer located at Cowra, operating in both the Mid Western and Western Regions. The clerical situation also has improved, with the appointment of an office assistant for Condobolin District Office.

Northern Region

Extension Training.—As a Regional level development in extension training, a 3-day extension workshop was conducted at Tamworth—jointly with North Western Region. The programme concentrated on the written and the spoken word in extension.

Mass Media Successes.—Northern Region, in co-operation with North Western, has established a most favourable reputation for the "Landmark" series of telecasts over NEN 9, Tamworth; evidenced by the Channel's renewal of the series in 1969—with a peak-viewing evening time-slot.

An intensive radio publicity campaign over 2TM, Tamworth, maintained for a month during the cereal harvest, comprised ten announcements daily—directed to the recognition and reporting of skeleton weed infestations. There was supporting press publicity. A similar technique was used in North Western Region. Indicating successful effort, the Central Northern County Council has reported that twenty-five new infestations were discovered in the Council's area, and that sixty requests for plant identification, inspections or contract spraying were received.

North Coast Region

Beef Industry Expansion.—Beef industry expansion in the North Coast Region is along two paths: (i) Conversion of former dairy country to a beef enterprise; (ii) Investment of non-rural capital in land, for its intensive development.

Dairy farm numbers in the Region are declining at a rate of 7 per cent per annum and, whilst a few are amalgamating to comprise larger dairy enterprises, most of those leaving dairy industry are turning to beef production.

Most of the development of land by using non-rural capital has been on country which was virgin forest when bought by the present developers.

The large-scale development of beef industry is significantly increasing the Region's beef cattle total; especially for breeding and fattening, as distinct from breeding for store production.

Publicity Officer's Churchill Fellowship.—Regional Publicity Officer Mr L. S. Edwards, returned from visiting as a Churchill Fellow various universities in the U.S.A., mainly the University of Illinois. At Illinois he completed an extensive survey since published by the university ("Education and Professional Improvement of Illinois Extension Advisers—Agriculture—as Related to their Use of Mass Media"). His studies in the U.S.A. of communication systems used by the co-operative extension service are proving to be very helpful to many extension officers in their design of mass and group communication activities.

North Coast Dairy Feed-Year Assistance Scheme.—Until late May, 1969, the season has been one of the worst experienced on the north coast and had a dramatic effect on farmers' ability to use the financial aid provided by the Scheme. Generally, farmers decided that prospects were too poor to risk sowing pastures and/or fodder crops. To the end of May, applications were at only two-thirds the rate of the previous year's corresponding period. Since the May rains, the rate has improved and in fact exceeded that of June, 1968. Farmers desperately short of standing winter pasturage have sown large areas of grazing oats.

North Western Region

A Continuing Regional Survey System.—A system of collecting production and management data by each extension officer using a farmer record card designed by the Region's economics research officer has been started. A card is made out, for each farmer contacted, and the information is transferred periodically to a single punchcard reference system for the Region—maintained by the economics research officer. The system helps to ensure that an extension officer has an appreciation of the whole-farm situation before he gives advice. It also ensures collection of a mass of production data for analysis, and for use in extension. Information is brought up to date as often as possible. The system is in fact a continuing survey.

Regional Staff Improvements.—Imminent appointment of an extension specialist, for North Western and Northern Regions, to do extension methods research and evaluation, will benefit all extension officers and extension work in the Region.

Recent appointment of a second economics research officer will help to meet the increasing demand on extension officers for farm management information. All extension officers' annual reports recorded that they were increasingly being asked for management advice, particularly in relation to reorganization of farm enterprises.

South Coast and Tablelands Region

Drought Relief.—Because of worsened drought conditions, particularly on the far south coast, large quantities of gift fodder were received from other areas. About 960 farmers (dairy, sheep and beef cattle) participated in the distribution throughout the Eden Pastures Protection District. By 24th December, 103,300 bales had been allocated. A few thousand bales more were distributed in January. Regional staff at Bega, with help from other areas, distributed the gift fodder during November and December, 1968. This was full-time work. Problems were added by the lack of close-at-hand rail facilities. Detailed organization and supervision of road transport, and unloading at all hours of the day and night, at many different points, were involved.

Yass Valley Project.—The Yass Valley Project Officer Mr D. V. Walters (seconded from the CSIRO to this Department for the past 7 years) accepted a transfer to the Department of Primary Industries, Queensland. He had been directly responsible for "Operation Tintacks" which involved the planning and supervision of development of three farms in the Yass River Valley. A principal feature of the project was the thorough documentation of every phase; that the lessons learned and information collected over the whole period might be used by other research and extension workers.

As the development programmes for the Yass Valley Project farms are not complete, arrangements have been made for economic records to be maintained and analysed at yearly intervals. The Yass Valley Organization is continuing its role, to maintain close liaison between the project farms, the community and government departments.

Research/Extension Liaison Committee.—Following disbandment of the Yass Valley Project Technical Committee (on the transfer of Mr Walters) a new committee was formed—called the Southern Tablelands Research/Extension Liaison Committee. It comprises representatives of this Department, the CSIRO, the Yass Valley Organization, and graziers.

The Committee's terms of reference, broadly are: (a) To develop and maintain an adequate system of liaison between research and extension workers, farm consultants and primary producers in the Southern Tablelands; (b) to draw attention to agricultural problems requiring investigation; (c) to bring about the dissemination of the results of research to all concerned.

The first activity arranged by the new Committee was a tour of inspection of district trials and demonstrations on pasture establishment (CSIRO and Department of Agriculture) by a group of agronomists and livestock officers from this and neighbouring Regions.

Southern Region

Administration Course.—The Regional Supervisor conducted an Administration Course over 2 days at Wagga. This was attended by seventeen Regional officers. Lectures were given by the Accountant, Assistant Secretary, Regional Clerk and Regional officers. The course, perhaps the first of its kind conducted outside head office, seemed particularly beneficial to the younger officers and those located away from Regional headquarters.

Pilot "Soil Phosphate Testing Service".—The pilot Soil Phosphate Testing Service was launched within the Southern and South Western Regions. The Regional headquarter's office had a major role in publicising the proposed service. District agronomists and field assistants did likewise in soil sampling, and by encouraging farmers to co-operate in establishing the field trials. Four hundred samples for the Wagga Agricultural Research Institute's analyses were taken, from 190 farms.

The Institute's reports were closely examined by District agronomists, for advisory recommendations to the farmers. This new service, in general regarded as progressing well, has brought about a new phase in research-extension-farmer relationships.

South Western Region

Group Extension.—A Rice Header Field Day at Whitton drew about 550 persons. Leading manufacturers demonstrated their headers under identical field conditions and growers were able to make comparisons. A "Beef to Dollars" symposium at Deniliquin attracted 150 persons and was aimed at assisting the Riverina's dairy cattle and beef cattle industries towards stabilization through diversification. A Dairy Exposition at Finley was attended by 430 persons.

Land Settlement Areas.—Land Settlement at Coleambally continued, with twenty-nine new farms occupied and another forty-one large area farms and seven horticultural farms ballotted this year.

The West Corugan Private Irrigation Scheme in the Corowa, Berrigan, Jerilderie and Oaklands districts, was officially opened by the Minister for Conservation on 12th April, 1969. The Scheme will serve 274 farms.

Western Region

Extension/Research Liaison.—This has been expanded, on a group and individual basis. It is coupled with more demonstrations of research results under commercial conditions.

Inter-Group Extension Involvement.—Acceptance of extension planning has led to active assessment of the group extension outlets available. Agricultural Bureau Branches remain the main avenue, but use of existing other producer organizations and the Show societies is also now more effective. Recent experience has been that by involving simultaneously a number of local groups in a particular activity, there are advantages in some areas where formerly support by each group was lacking.

Head Office Audio Visual Aids Sections

FILM AND PHOTOGRAPHIC SECTION

Cine Film Clips.—Three clips were filmed for rural television programmes. These dealt with milk production, cattle lice control and cattle tail tagging. Also 1,300 ft of raw film was issued to Regional Publicity Officers for local producers' preparation of clips.

Selected film was loaned to the Post Graduate Foundation of Veterinary Science, for television use by the Principal of the Royal Veterinary College, London, during his tour of Australia.

Cine Film Library.—220 programmes were collated and loaned to country officers for local screenings; as against 206 in 1967–68 and 203 in 1966–67.

Field Officers 35-mm. Photography.—14,970 photographs by field officers, as against 18,546 in 1967–68 and 20,645 in 1966–67, passed through the Photographic Aids Section for processing and return to the field as 35-mm. slides for extension uses. The photographs provided 8,300 colour and 6,670 black and white diapositives, as against 12,400 colour and 6,146 black and white in 1967–68. The increase in black and white photography and reduction in colour seemed due to the increasing needs of illustrative matter for television and publications.

Special Purpose Photography.—The Photographic Aids Section this year made 2,162 prints and enlargements, as against 2,079 in 1967–68. Regional officers' requests for larger prints increased, for television uses.

Some ninety-eight special photographic assignments were undertaken. These included work for the Departmental Careers booklet, and several special-purpose visits to decentralized research institutions.

Duplicate colour slides prepared from extension officers' originals totalled 183, compared with 139 in 1967–68.

The negatives loan-service was continued. It met requests by this and other Departments for publications' and display illustrative material.

DISPLAY/DESIGNING SECTION

Officers' demands for graphic materials for overhead projector and television uses increased notably.

The Section designed and mounted a special exhibit for the Department at the Orange National Field Day for the first time.

The 1969 R.A.S. Show display featured the many services of the Department to the rural community. Later this material was used also at Warren, to publicise the opening of a District office there.

The "Exotic Diseases Exhibit" designed for the 1968 R.A.S. Show has been displayed since then at seventeen country centres. Parts of it were used also interstate—by the Tasmanian, Western Australian and Queensland Departments.

Among other displays designed and constructed this year were one for the Public Service Careers Exhibit, in Apprenticeship Week, and one for the Annual Poultry Field Day at Hawkesbury Agricultural College.

RADIO AND TELEVISION

For the "Champion Farmer of the Year" Competition.—Five country radio stations, comprising a Mid State Network, again sponsored this competition and were serviced in part by tapes from this Section. This involved five by five minute sessions Monday to Friday, inclusive, on each Station. The series ran for 22 weeks this year, and three interview-talks per week were recorded for it—with head office and Science Service specialists. The other two sessions per week were provided from Regional sources. Relevant interviews were recorded also with the Chairman of the Grain Elevators Board.

For the Women's Service.—Twenty-three special tapes publicising women's service schools were prepared, and associated interviews of schools' lecturers were arranged with the A.B.C. and radio station 2GB.

For the Taxation Officers' Advisory Tour.—Prior to the tours of rural centres, radio scripts were written for 18 officers of the Taxation Department Advisory Tour Section. Interviews were recorded with each team of two, prior to the respective rural tour. The interviews were replicated and distributed regionally for broadcast.

For Head Office Specialist Officers.—Forty-three interviews/talks were recorded with specialist officers at head office and Rydalmere. Most were released regionally, but some tapes were specially for broadcast in the A.B.C. Country Hour.

TV Training Workshop.—This was conducted at Taree, for 3 days, for Mid Coast and Hunter Region officers. Closed-circuit TV equipment and also, for the first time, the recently acquired video tape recorder was used.

DISTRIBUTION OF MORE AUDIO/VISUAL AIDS EQUIPMENT

Twenty-five more 35-mm cameras were issued to country offices, bringing the total to 200.

Nine more broadcast-quality tape recorders were also acquired, to increase the recording facilities at Regional level.

Some Agricultural Bureau Notes

THE BUREAU BRANCHES

Branch Affiliation.—129 Branches of the Agricultural Bureau of New South Wales affiliated financially with their Advisory Council in 1968–69. There are 135 Branches in the mailing list. A year earlier there were 124 affiliated Branches.

Membership Total.—The total of Branch members for whom an affiliation fee was paid (to 31st May, 1969) was 7,093; an increase of 1,302 over the previous year's total. Some 83 per cent of members used the bank order system for payment of the fees.

New Branches.—Eight new branches were formed: Scone-Murrumbidgee, Queanbeyan-Canberra, Braidwood and District, Central Coast, Gilgandra and District, Moree, Cooma, and Lower Hunter.

Defunct Branches.—The small branches at Doyalson, Yarramalong, Mangrove Mountain and Barrington ceased to function. Members of the first three were absorbed into the new Central Coast Branch. Barrington members were absorbed into the Hastings Valley Branch.

Branch Activity Trends.—Subject matter areas wherein Branches have shown increased interest in the past twelve months have been marketing of primary products, farm economics, income tax, and investments. This has been indicated by the requested number of schools on these topics. Interest in schools concerned with cropping enterprises declined by comparison.

Two Bureau Branches in the Northern Region formed groups to be associated with analyses of economic data (from individual farms) through the University of New England Farm Management Computer Service. This type of Branch project seems likely to increase as the Computer Service expands.

THE STATE ADVISORY, REGIONAL AND DIVISIONAL COUNCILS OF THE BUREAU

State Advisory Council.—Each of the Agricultural Bureau Regions was represented in the State Advisory Council. Northern, Southern and South Western were represented by only one Councillor. Four Council meetings were held. Among the matters discussed was a review of all Sections of the Constitution. A sub-committee was established to further this review.

The State Conference (2nd to 4th July, 1968) was held at Terrigal and 132 delegates attended. The syndicate-discussion format was applied and was well-received by the delegates.

The Agricultural Bureau of N.S.W. continued formal affiliation with the National Farmers Union (N.S.W. Chamber), Rural Youth Organization, Water Research Foundation, Australian Association of Adult Education, Post-Graduate Foundation of Veterinary Science, Bush Nursing Association of N.S.W., and Associated Country Women of the World.

Regional and Divisional Councils.—Currently, Regional or Divisional (intra-Regional) Councils are functioning in seven Regions; four Regional and seven Divisional Councils in all. Activities sponsored by them this year comprised: the Central Coast-Cumberland Region's Stone Fruits Field Day at Hawkesbury Agricultural College (130 attended); the Mid Western Regional Convention at Forbes (sixty nominated delegates attended); the South Coast and Monaro Division's Pasture Symposium at Dalgety (sixty attended); the Mid Coast and Hunter Region's Convention at Paterson (100 attended); and the Richmond-Tweed Division's Machinery "Farm-arama" at Kyogle (attendance estimated as 2,000).

THE BEEF CATTLE BREEDERS' COMPETITION, 1968–69

The Rural Bank of N.S.W. and the Department of Agriculture again co-operated with the Agricultural Bureau to conduct this competition. There were 107 entries this year, as against 104 in 1967–68. The competition, now 17 years old, is credited with having contributed very considerably to the expansion and improvement of commercial beef cattle production in N.S.W.

The 1968–69 State winner was A. W. Couchman and Sons, "Marranoonbah", Condobolin. Second was N. D. Pinkerton, "Yarrowin", Scone, and third was Kippilaw Pastoral Co. Pty Ltd, "Kippilaw", Goulburn.

AGRICULTURAL BUREAU SCHOOLS AND COURSES FOR FARMERS

Through its Branches and Regional Councils the Agricultural Bureau of New South Wales conducted ninety-three schools and courses for farmers (ninety-five in 1967-68, seventy-seven in 1966-67 and fifty-eight in 1965-66) and also seventeen Homemakers Schools in association with the Women's Service.

Department of Agriculture officers were still the most frequent lecturers at Bureau schools, courses and meetings. Amongst the lecturers drawn from external sources were several whose professions are other than Agriculture. This reflected a growing interest in details of farm finances and diversification of funds. Personnel from State and Commonwealth Government Departments and from Universities, intra- and inter-State, also addressed Bureau functions.

The range of Agricultural Bureau schools—their places and topics, was as follows (with attendance figure in parenthesis):

Beef Enterprise Schools

Beef Cattle: six—Bathurst (55), Boorowa (30), Coffs Harbour (70), Forbes (22), Grenfell (51), Moree (140); *Advanced Beef Cattle*: one—Muswellbrook (140); *Beef Production*: two—Dunedoo (36), Quirindi (45).

Sheep Enterprise Schools

Clip Presentation and Wool Marketing: one—Parkes (50); *Drenches and Drenching*: one—Grenfell (65); *Prime Lamb*: one—Narrabri (40); *Reproductive Performance of Sheep*: three—Blayney (55), Cootamundra (100), Jingellic (14); *Wool and Lamb*: two—Bingara (10), Inverell (60); *Wool Production and Marketing*: five—Bathurst (45), Cowra (93), Goulburn (80), Merah North (not recorded), Parkes (80).

Pasture/Fodder Enterprises Schools

Fodder Conservation: one—Braidwood (50); *Lucerne Production*: one—Bathurst (70); *Pasture Establishment and Management*: five—Boorowa (28), Braidwood (56), Condobolin (60), Dalgety (60), Trundle (12); *Pasture Utilization*: five—Cowra (70), Eurimbla (15), Gunnedah (not recorded), West Wyalong (60), Willow Tree (not recorded); *Pasture Seed Production*: one—Queanbeyan (45).

Cropping Enterprise Schools

Advanced Fertilizer: two—Dubbo (22), Parkes (25); *Cereal Production*: two—Cowra (45), Grenfell (50); *Farm Woodlots*: one—Goulburn (40); *Fertilizer*: two—Queanbeyan (27), Jingellic (8); *Weeds*: one—Trundle (30); *Wheat Nutrition*: two—Coonabarabran (60), Gilgandra (50); *Wheat Production*: two—Merriwa (25), Muswellbrook (50).

Agricultural Engineering Schools

Bulk Handling of Wheat: three—Baradine (85), Dubbo (45), Mudgee (25); *Farm Machinery*: one—Dunedoo (not recorded); *Fencing*: one—Baradine (not recorded); *Tractor Maintenance*: three—Coffs Harbour (30), Nambucca (15), Maclean (not recorded); *Welding*: two—Coffs Harbour (18), Macksville (20).

Farm Economics Schools

Business Side of Farming: one—Young (25); *Farm Management*: four—Coleambally (63), Narrabri (25), Walgett (23), Wyong (44); *Financing Farm Development*: one—Queanbeyan (80); *Income Tax and Estate Management*: eight—Bathurst (55), Gilgandra (24), Lithgow (25), Mudgee (20), Orange (45), Parkes (22), Wellington (39), West Wyalong (50); *Investment on the Stock Exchange*: two—Orange (76), Mudgee (26).

Other Schools

Animal Health: one—Grenfell (72); *Beekeeping*: two—Young (15), West Wyalong (7); *Farm Water Supplies*: three—Bathurst (21), Dubbo (25), Mullion Creek (9); *Graziers*: two—Goulburn (54), Tuena (50); *Irrigation*: one—Walgett (28); *Land Clearing and Development*: one—Coonabarabran (not recorded); *Management Practices for Winter Production*: one—Cooma (35); *Pig Production*: three—Coonabarabran (40), Goulburn (30), Narrabri (42); *Public Speaking and Meeting Procedure*: six—Baan Baa (19), Baradine (32), Condobolin (24), Spring Ridge (35), The Entrance (30), West Wyalong (21).

OTHER SCHOOLS/COURSES FOR FARMERS

Besides the Group activities conducted by the Agricultural Bureau and Women's Service (see later), the Department's extension services conducted sixty-three other schools for farmers—either at rural centres or at one or other of the Agricultural Colleges. The range of these schools, per topic, and place was as follows (the figure in parenthesis indicating the attendance):

Livestock Management Schools

Beekeeping: two—Hawkesbury Agricultural College (22), Tamworth (34); *Beef Cattle*: five—Casino (80), Orange (52), Tenterfield (70), Wagga Agricultural College (27), Wingham (160); *Dairy Farming*: two—Hawkesbury Agricultural College (20), Nowra (140); *Drought Management*: three—Glen Innes (60), Nowra (50), Pyree (not recorded); *Graziers*: two—Glen Innes (60), Walcha (not recorded); *Irrigation and Animal Husbandry*: two—Balranald (52), Wentworth (24); *Mastitis Control*: three—Berry (not recorded); Grafton (not recorded), Maitland (not recorded); *Meat Products and Small Goods*: one—Hawkesbury Agricultural College (60); *Pig Raising*: six—Bega (6), Hawkesbury Agricultural College (41), Newcastle (35), Talgum (21), Wagga (200), Wyalalga (not recorded); *Poultry Production*: two—Hawkesbury Agricultural College (60), Wagga Agricultural College (not recorded); *Sheep*: three—Berrigan (40), Sandigo (60), Tumut (17).

Crop and Pasture Management Schools

Controlled Atmosphere Fruit Storage: one—Orange (300); *Irrigation*: two—Berrigan (100), Narromine (110); *Potato Growers*: two—Finley (90), Guyra (10); *Rice Growers*: two—Deniliquin (140), Jerilderie (20); *Summer Crops*: one—Delungra (not recorded); *Weeds*: two—Leeton (30), Queanbeyan (50); *Wheat*: two—Garah (45), Spring Ridge (68).

Farm Economics Schools

Dairy Farm Finance: one—Dungog (45); *Farm Management*: five—Grafton (11), Tambar Springs (25), Tamworth (13), Taree (50), Wagga Agricultural College (50).

Agricultural Engineering Schools

General Machinery: two—Gunnedah (45), Narrabri (70); *Grain Handling*: four—Blighty (30), Moree (50), Mungindi (not recorded), Weemalah (not recorded); *Tractor Maintenance*: four—Grafton (70), Hawkesbury Agricultural College (13), two in Southern Region (60); *Welding*: five in Southern Region (58).

Several others schools/courses/conferences organized and conducted by officers of the Department concerned In-service Training.

Women's Extension Service

SCHOOLS FOR RURAL WOMEN

The Women's Extension Service organized 23 one-day schools, as against 43 in 1967-68, and 57 in 1966-67. Seventeen of the 23 were in association with Agricultural Bureau Branches or Councils and six with Branches of the Country Women's Association. Twelve of the schools were tutored by personnel from external sources. Distribution of the schools, per topic, and place was as follows (the figure in parenthesis indicating attendance): *Advanced Dressmaking*: Trundle (14); *Be Wise—Organize*: Coleambally (18); *Drying Flowers*: Condobolin (32); *Flower Arrangements*: two—Marrar (48), Tenterfield (86); *Gardening and Garden Design*: Bedgerebong (44); *Home Furnishing and Decoration*: nine—Arcadia (27), Bingara (37), Coffs Harbour (25), Condobolin (43), Cowra (43), Dunedoo (29), Inverell (39), Jerilderie (37), Macksville (40); *Personality with Poise*: Narrandera (45); *Speaking in Public*: Orange (39); *Voice, Speech and Personality*: three—Dubbo (40), Orange (32), Wyong (32); *Wardrobe Planning*: three—Boorowa (9), Eurimbla (28), Legume (86).

The CSIRO, the N.S.W. Department of Public Health, the Australian Gas Light Company, Australian Dairy Board, Australian Fruit Board, Meat and Allied Trade Federation, Sydney Building Information Centre, Sydney County Council, Wool Board, Horticultural Society of N.S.W., the country press and a wide range of authorities/associations/trade organizations, wholesale manufacturers/retail firms continued to assist the Division's promotion of extension services for rural women.

OTHER MEDIA OF WOMEN'S EXTENSION SERVICE

Individual Enquiries.—Requests for information by correspondence totalled 390, as against 198 in 1967–68 and 164 in 1966–67, and were concerned with specialized recipes (168), food preserving (103), deep freezing of foods (47), home furnishing (7), and miscellaneous (65).

By 'phone there were 739 enquiries, and there were forty-seven in-person enquiries at head office.

Radio and Press.—Thirty-four press statements were prepared; mainly concerned with the organization of schools, and twenty-three tapes were recorded for release to radio stations through Regional Channels. Three other tapes were specials in association with the ABC and radio station 2GB. Eight guest-contributions to the Farm Home pages of the Agricultural Gazette were arranged.

Commonwealth Extension Services Grant (C.E.S.G.)

The Chief, Division of Extension Services is responsible to the Director-General for administration of the C.E.S.G. funds made available by the Commonwealth through the Department of Primary Industry to enhance extension and applied research.

For 1968–69, the allocations for the various Projects aggregated \$918,046; as against \$752,100 in the previous year. The following tabulation, comparative for 1967–68 and 1968–69, lists the Projects and allocations.

Project	1967–68	1968–69
	\$	\$
501 Research Officers	37,810	65,075
502 Extension Officers	121,577	156,272
503 Field Assistants	98,683	109,153
504 Technical Laboratory Assistants	37,386	46,742
505 Equipment	137,727	171,181
506 Motor Vehicles	39,906	52,600
507 Buildings	58,900	75,109
508 Materials for Demonstrations ..	7,042	26,641
509 Extension Aids	19,450	19,030
510 Publications and Books	40,770	34,104
511 Overseas Visits	76,231	22,715
512 Grade Herd Recording	76,618	71,200
513 Conferences, Schools and Training—Australia	(In Proj. 511)	68,225
	<u>\$752,100</u>	<u>\$918,046</u>

HAWKESBURY AGRICULTURAL COLLEGE

General

TRENDS

The College made considerable progress towards its objective of providing tertiary courses in the three current Diploma Courses, when it becomes a College of Advanced Education, in 1970. Minimum entry standards have been raised to Higher School Certificate level with passes in English and Science mandatory. Progress was made also towards the new courses in Poultry Technology and Rural Extension.

Boards of Studies have been appointed to review curricula. Senior and supporting staff positions have been established to programme and operate the new curricula.

The building programme received considerable stimulus from Technical and Advanced Education Grants. Further substantial funds have been allocated from the latter source for the 1970–72 triennium.

THE BOARD OF STUDIES

Pursuing the intention to match higher entry standards with tertiary level training, the Committee of Advice appointed members to two Boards of Studies; a Board for the Agriculture Diploma Course and a combined Food Science Board for the Food Technology and Dairy Technology Diploma Courses.

The Boards of Studies in turn have appointed Subject Advisory Committees; each comprising representatives from Government departments, universities, industry and the Colleges. The Committees are to review curricula.

The Agriculture Diploma Board of Studies has made notable progress towards introduction of a new curriculum.

The Food Science Board of Studies is committed to availability of a Third Year in Dairy Technology in 1970, and is considering extending the Food Technology Course to 3 years in 1971. The Third Year in Dairy Technology was in fact available in 1969 as an option but because of late publicity there were insufficient qualified applicants with whom to launch it.

Further improvements in the 2-year course have been implemented by the introduction of internal theory examinations, in subjects covering syllabi of Certificates of Competency issued under the Dairy Industry Act, and external practical examinations in those subjects in the Second Year. These procedures will ensure that each student has at least 12 months' experience in a dairy produce factory before receiving the Certificate of Competency required by the Dairy Industry Act.

Each Board of Studies is working towards unit-based courses, with a core of essential subjects to preserve breadth and a series of electives in applied subjects in senior years to permit some specialization.

Steps are being taken for added recognition of Diplomas awarded after 1972, and for diplomates with pre-1972 diplomas to convert from the old to the new diploma.

NEW DIPLOMA COURSES

Diploma courses in Poultry Technology and Rural Extension are to be established in 1970. The Poultry Technology Course will be of 2 years' duration with similar entry standards to the existing Diplomas after 1970.

The Diploma in Rural Extension will be a post-diploma, 1-year course open to diplomates, or to graduates in appropriate faculties, with 3 years additional experience.

TEACHING POSITIONS

Staff strengthening is proceeding in all disciplines and at all levels, to meet the extra demands of a tertiary level Diploma and provide for students an educational challenge equivalent at least to that of a 3 year university degree course.

Chief Lecturers have been appointed in each of the three existing Diploma Courses. Their major responsibility is in curricula matters, to ensure development and maintenance of the standards sought.

An Executive Officer and a Liaison Officer have been appointed to the administrative staff. They will shortly take up duty, to assist the implementation of new courses and the greatly expanded works programme.

Further reinforcement of staff will be through appointment of a third Chemistry Lecturer, a Food Technology Lecturer and an Economics Lecturer. A Senior Lecturer has been appointed to pattern the Poultry Technology Course. Advertisements have been placed for a Chief Lecturer and a Lecturer for the post-diploma Diploma in Rural Extension course.

BUILDING PROGRAMME

Teaching facilities were considerably improved by completion of the Animal Husbandry Unit comprising lecture and demonstration rooms and the Dairy Technology laboratories, lecturing and seminar rooms, and offices.

Other teaching facilities at an advanced stage include an Abattoir, a Beef Cattle Demonstration building and yards, five Poultry Demonstration buildings, and extensions to the Farm Machinery Demonstration building.

Work has begun on a new student residential block, with funds from the Commonwealth Advanced Education Grant. Plans are well advanced for Stage I of a Food Technology tutorial block, with funds from the same source; also for a School of Engineering with funds from a Technical Training Grant.

With carryover funds from the 1967–69 triennium, a sum of \$1,394,500 has been allocated for the triennium 1970–72 for Advanced Education projects. These include completion of Stage II of the School of Food Technology, teaching facilities for the Poultry Technology Course, renovations to student accommodation, administration and Dairy Technology buildings, installation of a modern sewerage system, and improved boiler capacity in various sections.

Considerable maintenance, construction and renovation work has been done by College staff and contractors. New equipment has been installed in many sections to improve the teaching and demonstration situations.

The Three Diploma Courses

STUDENT NUMBERS, QUALIFICATIONS, AND MOTIVATIONS

Agriculture Diploma.—At present 172 students are in the Diploma of Agriculture course; and 53 are the sons of farmers and graziers. Of the 172 students, 57 are in Agriculture III, 49 in Agriculture II and 66 in Agriculture I.

Fifty-eight of the 66 students admitted into Agriculture I in 1969 have the Higher School Certificate (or equivalent), and eight have the Leaving Certificate or 5th Form background.

Thirty-four of the 66 students in Agriculture I have expressed a definite intention to seek career positions in Government Service or private industry after graduation. Of the 19 who are indefinite at this early stage, most are considering career positions. Only 13 of the 66 have definite plans to go on the land; 22 of the 66 are sons of farmers or graziers.

Dairy Technology Diploma.—Thirty-seven students are currently enrolled—21 in First Year and 16 in Second Year. Admissions to First Year in 1969 included 14 from N.S.W. (three Dairy Factory apprentices), 2 from South Australia, 3 from Tasmania, 1 from Victoria, and 1 from Indonesia. Five of the N.S.W. students are without financial assistance.

Minimum entry standard in 1969 was the School Certificate but each entrant had either the Higher School Certificate or Leaving Certificate.

The present course is being critically appraised to ensure that diplomates are adequately trained for the positions they fill. Attention is being given also to the desirability of offering, possibly in conjunction with other organizations, training for other types of personnel needed in dairy products manufacture.

Food Technology Diploma.—All 10 students admitted to the Food Technology Course in 1969 have the Higher School Certificate or equivalent qualifications; with English, Mathematics and Science passes mandatory.

Twenty-three students are currently in the Food Technology course; 13 in First Year and 10 in Second Year.

ASSISTED STUDENTS

In 1969 there are 33 Public Service Board trainees (for Department of Agriculture and Department of Soil Conservation) in residence.

Of the 232 students in residence, 146 (63 per cent) have bursaries, scholarships, traineeships or other forms of sponsorship. Specifically in Food Technology the percentage is still higher (74 per cent), with 17 of the 23 students receiving financial assistance by way of a sponsor or a scholarship. The Food Technology Association of New South Wales provided a scholarship for a student to enter in 1969.

DIPLOMAS AWARDED—MAY 1969

Agriculture.—The Hawkesbury Diploma in Agriculture was awarded to 45 students. Four gained Honours Class II. Deeply regrettable, one of the 45 awards was posthumous.

Dairy Technology.—Nineteen students were awarded the Diploma in Dairy Technology. One gained Honours Class I and one gained Honours Class II.

Food Technology.—Four students were awarded the Diploma in Food Technology.

EMPLOYMENT OF THE RECENT DIPLOMATES

Agriculture.—The 44 diplomates from the 1968 class (the other was victim of a fatal accident) are engaged in the following fields:

On farming and grazing properties	9
In Government Departments:	
(a) State Departments	20
(b) Other Government Agencies	3
In private firms (agricultural supplies and services) as technical representatives, etc.	1
In companies associated with agricultural and pastoral industries	1
In University studies	4
In National Services, miscellaneous, or not known ..	6

Dairy Technology.—Of the 19 diplomates from the 1968 class, 9 are currently employed in New South Wales in the dairying industry, 3 in Victoria, 3 in Tasmania and 1 in each of South Australia, Singapore and Uganda, whilst 1 diplomate is continuing studies—in the Food Technology Course.

Food Technology.—All four diplomates from the 1968 class are currently employed in New South Wales food industry.

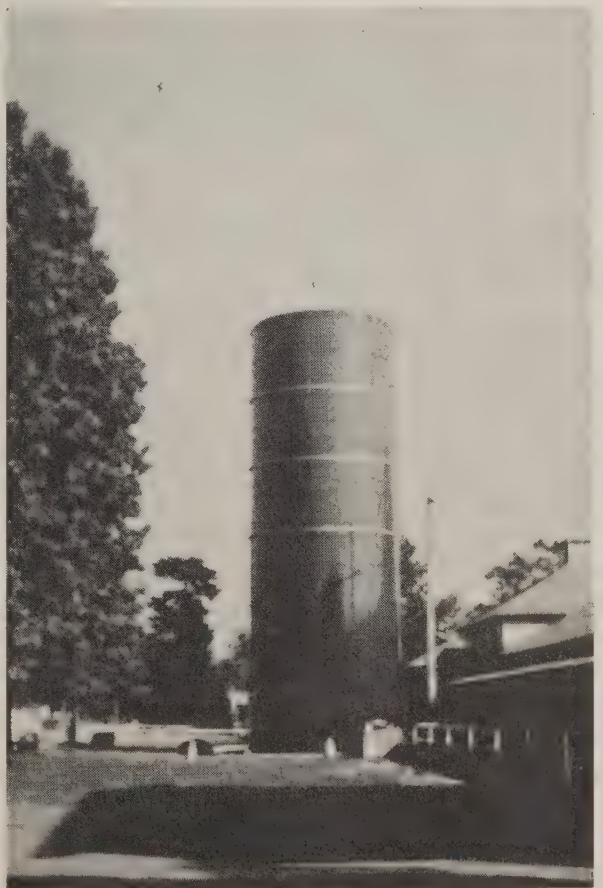
PRACTICAL TRAINING

Provision of practical training is emphasized in all three Diploma courses; through field work, or factory activities as the case may be, extra-mural training, organized demonstrations and tours.

All students participated in a number of single-day tours to reinforce and supplement study programmes. Final-year students partook major tours; the Agriculture students touring in northern, western or southern districts; the Dairy Technology students in the Hunter Valley district, and the Food Technology students in southern districts and Victoria.

EXTRA-CURRICULAR ACTIVITIES AND PUBLIC RELATIONS

Extra-curricular activities continued their importance. The various teams observed the high tradition of College sport. Positive contributions were made to the social life and welfare of the College by the Students' Representative Council, the Sports Club, the Debating Society, the Camera Club, the Students' Christian Movement, the Frates Colendi, the College Branch of the Agricultural Bureau and the Hawkesbury Collegians Service Club.



New Aid in Fodder Production/Conservation at Hawkesbury College

The College Dairy Section's "Harvestore"—65 ft high, 14 ft diameter, 250-ton capacity; a glass lined steel structure, completely sealed. Haylage material is blown in at the top and unloaded at the bottom—allowing continuous filling and emptying. Crude-protein estimations on the haylage processed through the Harvestore are providing data on feeding values before and after the processing.

The College, proud of its widespread fine reputation, continued to enhance its relations with people and with many organizations.

Visitors continue to arrive on the Regular Visitors' Day (Thursday) and in such numbers that staff and students are rostered for the occasion. By special arrangement on other days, including weekends, individuals and groups have been allowed to inspect the College. Most of the visitors have a real interest, general or specific, in the College and its activities. The visits, however informal, are acceptable to the College as contributions to extension as well as public relations. Amongst the visitors were agriculturists from other States and from overseas, including many from Asia.

The College continued reciprocally co-operative relationships with the many government, semi-government and private organizations: other State Government Departments, the Commonwealth Department of External Affairs, the CSIRO (several Divisions), the Atomic Energy Commission, ABC, Universities, Banks, Local Government bodies, growers' organizations, various technical societies, many corporations associated with agriculture, the Agricultural Bureau and the Rural Youth movements.

Short-term Schools and Conferences at Hawkesbury

The following short-course schools and conferences were held at the College (attendances in parenthesis): Milking Machine Operators' Schools (14); Extension Service/Methods School (49); Herd Recorders' School (37); Rabbit Control Refresher Course (33); Food Plant Foreman's School (51); Fruit Officers' Extension School (40); Rural Youth Schools—Tractor Operation and Maintenance (15), Dairy Cattle (17); Poultry Servicemen's, Technicians' and Producers' Course (25); Pig Raisers' School (48); District Agronomists' Conference (60); Summer School in Apiculture (21).

Some College Sectional Operations

FARM; AGRONOMY RESEARCH; ORCHARD; SHEEP; BEEF CATTLE; DAIRY CATTLE; PIGGERY; POULTRY; APIARY; DAIRY TECHNOLOGY; FOOD TECHNOLOGY

Farm Section (including Horse Statistics)

Crops and Pastures.—The prevailing dry to drought conditions of the spring and summer were broken by a substantial improvement, from February onwards, resulting in a very good autumn and early winter.

Wheat and oats sown in autumn, 1968, gave only limited grazing in the dry conditions. Some 3,500 bales of hay were harvested but no grain. By contrast, 350 acres of oats and 100 acres of wheat sown during autumn, 1969, have made excellent growth, and the oats has already provided a heavy bulk of feed. A large tonnage of hay seems likely.

Fifty acres of Japanese Millet were harvested for haylage. Excellent crops of maize, made into haylage, saccaline, for silage, and grain sorghum were grown at the River Farm under irrigation.

A further 28 acres of lucerne were established, bringing the total to 88 acres. Land is being prepared to increase the lucerne acreage. All of the lucerne areas are irrigable.

Pasture production except where under irrigation was not favoured by the weather, until autumn. Both improved and unimproved pastures then recovered rapidly. Seventy acres of mixed pasture has now been sown in the Clarendon area and has germinated well.

Conserved Fodder.—At 30th June, 1969, the position was sound with the following on hand: 470 ton of cereal hay, 80 ton of pasture hay, 121 ton of lucerne hay; 1,518 bus of wheat and 150 bus of grain sorghum; 200 ton of tub silage and 1,400 ton of pit silage; 100 ton of haylage, and 846 bags of various concentrates.

Irrigation, and Dams.—At 30th June, 1969, the Turkey Nest and the Hillside dams were full to safe-holding capacity. The programme for the forthcoming summer provides for repair to the bank of the Hillside dam to raise its capacity by 10 million, from 8 to 18 million gallons. A new dam has been built near the main driveway and is to be used in lieu of town water to irrigate pastures in that area.

Horses.—The horse total at 30th June, 1969, is sixty-three, including forty-three in the Arab stud.

Agronomy Research

Detail of the work and results of this section of the College activities has been reported to and incorporated in the report of the Division of Plant Industry. An outline of the areas of work is as follows:

Plant Breeding.—Over 120 determinate and indeterminate type tomato parents, introductions and breeding lines were tested for yield and for reaction to Fusarium wilt and skin cracking, and 148 stringless and stringed bean parents, breeding lines, and introductions were tested for resistance to rust and to summer death.

A canning yield trial was conducted with pea breeding lines, tested also for quality.

Selections were made for rock melon mother seed distribution to seed firms, from "Yanco Treat" and "Yanco Delight".

Miscellaneous Crop Trials.—Trials were conducted with maize varieties, sorghums for grazing and for silage, millets for grazing, and sweet corn varieties for yield and quality testing.

Weeds Research.—Herbicide trials were carried out with lettuce, carrots, beetroot, tomatoes, maize, sorghum, sweet corn, cabbage and cauliflowers, and beans. Also a weed control trial in potatoes was laid down at the Orange Agricultural Research Station and a beetroot weed control trial was conducted at Cowra.

Co-operative Research.—Co-operative research was carried out with the Sydney University wheat research unit, the CSIRO Division of Food Preservation, various Divisions of the Department, seed firms and various chemical firms. Co-operative weeds research continued with Geigy Australia Pty Ltd.

Extension Activities.—Field days were held on market tomatoes, stringless and stringed beans for canning and market, and on sweet corn varieties. Information was given to farmers by personal contact, letter and telephone.

Orchard Section

Crops and Developments.—Growth and cropping of most trees and vines were excellent. About 1,200 bus cases (citrus, stone, pears, grapes) were harvested from 13 acres. Growth of nursery trees and of young plantings were outstanding.

Small areas of the orchard were reconstructed by the removal or renovation of old and the planting of new trees. All plantings of trees and vines were maintained in good condition, helped by irrigation. A "drag-hose" supplementary irrigation system was installed in part of the orchard. Herbicide weed-control demonstration areas were established.

Orchard Field Day.—This was held in January, 1969. It was well attended and successful. This was not the only extension activity. Throughout the year advice was given on fruit growing matters through personal contact with visitors, and by telephone and correspondence. Demonstrations and discussions on various horticultural practices were conducted for visiting groups.

Sheep Section

Lambing, 1968.—One hundred and seventy-one Merino ewes (40 per cent "lambs marked") and 277 crossbred ewes (93.8 per cent "lambs marked") lambed. Cold weather at lambing contributed to losses heavier than usual. Large numbers of dry ewes were also a problem, because of low body weights at mating—a drought effect. In the poor merino lambing, ram infertility was also a factor.

Mating, 1969.—Mating was done in good conditions. Two hundred and eighty-five crossbred ewes were mated to Dorset and Poll Dorset rams and 25 crossbred ewes were mated to Growmark rams on 12th February, 1969, and 187 Merino stud ewes were mated to stud rams, 43 Merino ewes to Border Leicester rams, 43 Merino ewes to Growmark rams, and 50 Growmark ewes to Growmark rams on 2nd April, 1969.

Flock Statistics.—At 30th June, 1969, the 1,106 head comprised 269 Commercial flock ewes, 187 Merino flock ewes, 36 Merino flock hoggets (rams and ewes), 549 ration sheep and general demonstration animals, and 65 Demonstration flock rams.

At shearing, 40 bales weighing a gross 11,183 lb was the result—netting near to \$4,000.

BEEF CATTLE SECTION

Total Beef Cattle Numbers.—Cattle total, all herds, varied from a record 350 to the total of 313 at 30th June, 1969.

Stud Herd.—Stud herd female section has been re-organized and about 50 per cent of the females were culled to the Commercial herd. Twelve Poll Hereford stud heifers were bought from Mr J. H. Chew, "Dananbilla", Young, to help rebuild the breeder numerical strength.

The Stud herd now comprises fifty-one females of all ages, and thirteen males. Two bulls are on loan to the Graham Park Artificial Insemination Centre, Berry, and six weaning bulls are being evaluated in the current Sire Selection demonstration.

Sires used in the past year were "Kildrummie Toledo", "Kildrummie Youth", and the young College-bred bull "Hawkesbury Freebooter 9th". The latter was selected on his performance test. His calves' production will be of special interest. Use of performance-tested bulls selected from the Sire Selection Demonstration will be emphasized in future breeding programmes. This follows from the establishment of sufficient sire lines to minimize the influence of inbreeding. Six yearling bulls were sold privately this year.

Commercial Herd.—This has expanded to a commercial breeding unit optimum for teaching purposes. Transfer of many of the Stud females to this herd has achieved this. Herd size has been expanded to some eighty breeders plus replacement heifers. Culls and steer progeny are diverted to ration purposes after the demonstration work.

Influence of the Stud sires on the Commercial herd is now quite clear, measured through performance testing programmes and the associated selection pressure this year.

Steers from the "Steer Production Demonstration" were again exhibited at the R.A.S. Steer and Carcass Show. The steer entered in the single classes, milk tooth under 900 lb liveweight, won both the "hoof" and "hook" class.

Demonstration Herd.—This, too, is now at the optimum, in terms of diversity of breed material and, as such, is a unique herd for student instruction. Some fifty females have been organized into it. All breeds of economic importance to the Australian beef cattle industry are now represented. Latest added were two Murray Grey heifers purchased through Mr M. Gadd, "The Glen", Wodonga, Victoria. Also, a full range of Brahman hybrid and three way cross heifers were recently selected for breeding.

Results of the crossbreeding work in this herd have been invaluable for student instruction but have also kindled great interest by beef cattle producers throughout the Commonwealth. Criss-cross and Rotational crossbreeding demonstration were initiated this year. Various dairy breeds are also being used, for multiple suckling demonstrations, in addition to the dairy/beef production methods.

The Brahman bull "Lawes Scimitar" and the Friesian x Brahman hybrid bull "Hawkesbury Jumbo" have been used exclusively in the Demonstration Herd breeding programmes.

In conjunction with Professor Butterfield, School of Veterinary Science, Sydney University, total muscle dissections were done on a Brahman x Friesian hybrid steer to evaluate carcass merit. The results were outstanding. Also through the Professor's co-operation, a "double muscled" Angus bull was here on loan from Sydney University for student instruction. The animal was in due course slaughtered for carcass analysis, with considerable value in course work.

Ration Herd.—Ninety head, nominally valued at \$12,000, were slaughtered for rations. Most were produced on the College, but some were transfers from other Research Stations.

Dairy Cattle Section

Breeding Programme.—Canadian-bred bulls and their progeny were again used extensively. First calves of "Hawkesbury Lenora King 2nd" show much promise, as do some calves sired by "Golden Valley Rex".

Semen of "Fraser Lord Jewel" is now of very poor quality and conception rates are low.

Twenty-five ampoules of Charollais semen have been obtained. Two Friesians have been inseminated and four more will be shortly. The calves are for trials in the Beef Section.

Friesian Stud Statistics.—At 30th June, 1969, the total was 163 head, comprising 8 adult bulls, 8 loan bulls, 54 cows in milk, 14 dry cows, 31 heifers, and 48 calves under 12 months of age. Births during 1968-69 totalled 66, comprising 34 males and 32 females.

Stud Sales.—College Friesian cattle are in high demand, with a waiting list of 2½-3 years for young bulls. Fourteen head were sold this year, for a total of \$3,705—an average of \$265. In the previous year twenty-six were sold—averaging \$240, and two years back thirty-four were sold—averaging \$165. The fall in number of animals sold in 1968-69 was in part due to the increased transfer of stock to other Departmental institutions, for demonstration and research, and the loans to N.S.W. Milk Board artificial-breeding centres.

Herd Production Averages.—The latest herd recording figures available provide the following record averages, for the 12 months ending 30th June, 1968.

Age	55 Cows	Total milk	Total fat	Average test
2 years old	9	10,143	373	3.7
3 years old	5	12,462	476	3.8
4-9 years old	34	13,999	511	3.6
Over 9 years	7	13,440	486	3.6
Herd averages		13,157	482	3.7

The College was fourth in the State for herds of over forty cows; in butterfat and in milk production.

Exhibition of Cattle at Shows.—A team of fifteen College Friesians at the 1969 Sydney Royal Show gained 6 Firsts, 9 Seconds, 7 Thirds, 3 Fourths and 2 Fifths. "Hawkesbury Jewel Rosemaid 2nd" was chosen as a member of the group of five cows in the "Allied Feeds-John Darling" Interbreed shield and the group was placed 1st. The College was also Most Successful Exhibitor for the ninth consecutive year, and Most Successful Breeder in the Friesian section. A heifer with calf at foot and a young bull were sold by public auction and realized a total of \$1,300.

A team of seventeen at Hawkesbury District Show "scooped the pool" for the College in the Friesian section. It gained 14 Firsts, 8 Seconds, 3 Thirds and 7 Championships. "Hawkesbury Jewel Bonnie" was judged Supreme Champion Cow of the Show, and the College was Most Successful Exhibitor in the Friesian Section.

The Demonstration Herd.—This herd, to acquaint new students with the different breeds of dairy cattle, now comprises two Guernsey cows from Yanco Agricultural Research Station, and a heifer and a bull calf; two Jersey cows from Wagga Agricultural College, one Ayreshire cow from F. A. McIntosh, Berry, and a heifer over 12 months and a heifer under 12 months, one A.I.S. heifer over 12 months and one under 12 months.

Piggery Section

The Stock.—High quality production was maintained. Boars were introduced from Mrs McDonald, Oldbury Stud, Moss Vale, and from Wollongbar Research Station.

The present breeding stock comprises one Tamworth boar and six sows, two Berkshire boars and eight sows, three Large White boars and nineteen sows, three Landrace boars and sixteen sows; a total of nine boars and forty-nine sows.

Average monthly holding of stock was much greater than in the previous years, but the total at 30th June, 1969, was 266 head as against 304 a year earlier.

Sales.—The depressed state of the pig market reduced considerably the demand for Stud pigs. Prices remained unchanged at \$10.50 per month of age. Considerably more pigs were forwarded for sale to Homebush yards and Riverstone Meat Works. Stud sales comprised eighteen head, for \$1,145, and pigs marketed totalled 341 for \$8,831.

Pigs were supplied also to other Departmental institutions, and to Glenfield Veterinary Research Station, to Royal Alexandra Hospital for Children and to Sydney University, for research purposes.

Schools and Demonstrations.—A successful school for pig raisers was held, with capacity attendance. Demonstrations were conducted also for veterinary students of Sydney University.

Poultry Section

Random Sample Layer Tests.—The 16th Random Sample Layer Test ended in November, 1968. A final report has been published. Interim reports were published at intervals of 28 days.

The 17th Test started in August, 1968, with twenty-four entries. There are twenty-six entries for the 18th Test.

Pure Breeds Test.—The 7th Pure Breeds Test ended in November, 1968. The final report has been published. Interim reports were published at intervals of 28 days. The 8th Pure Breeds Test started in August, 1968.

Field Day and Short School.—The annual Poultry Farmers' Field Day was held on 28th September, 1968. The theme was "Environment Control" and the exhibiting firms pursued it. Attendance was estimated as 1,000.

A short-term school for Poultry Servicemen was conducted in September and all sessions drew good attendances.

Apiary Section

Statistics.—At 30th June, 1969, there were ninety-six productive hives and forty nucleus hives, compared with ninety and fifty respectively at 30th June, 1968.

Queen Bee Supplies.—Adverse spring conditions, and abnormal winds continuing into November, made it difficult to establish queen rearing nuclei and to produce queen bees. Drought forced the closing down of queen rearing operations until early autumn. January rain and a favourable autumn provided good bee breeding conditions and it was possible to supply all orders received for queen bees. Some 666 queens were supplied, despite the earlier setback.

Several nucleus colonies were made available for holding imported Russian-type Caucasian queen bees in a quarantine enclosure at Division of Science Services, Rydalmere. Thirty other nuclei were drawn from bees at Wyong to hold another strain of Caucasian queens until next spring, for a crossbreeding trial with Italian strains.

Production.—The productive colonies located at Bathurst did not secure any surplus honey and had to be moved to the Wyong district, to obtain winter stores from autumn flowering Spotted Gums. No honey was extracted this season.

Summer School and Field Day.—The annual summer school in Apiculture was from 6th to 10th January, 1969. Also, demonstrations were given at the Amateur Beekeepers Association Field Day, held at the College on 22nd February, 1969.

Dairy Technology Section

General.—Shortage of milk for manufacturing purposes was acute in spring and summer, due in large part to the dry conditions. Supplies of surplus milk for student instruction and commercial manufacture into cheddar cheese and cream for buttermaking were pursued for the first half of the year by inviting tenders for 3,000 gallons of milk per week. But the price was at least 20c per lb of butterfat more than the factory could pay, under present working conditions. Three alternatives under consideration are:

(a) Concentrate in spring and summer on the practical instruction in cheddar cheese and buttermaking, as has been done for several years, but purchase only 2,000 gallons of milk per week when milk is available at a lower price; rearrange demonstration batches of fancy cheese to fit into autumn and winter, and purchase smaller quantities of milk if and when required to make such cheese.

(b) Investigate the possibility of obtaining a subsidy from Education funds to bridge the gap between the price of milk and what the factory can pay.

(c) Investigate the possibility of the College withdrawing from the Equalization scheme.

Butter Section.—Supplies of cream again diminished, compared with 1968. Emergency supplies were obtained from Albury during final practical buttermaking examinations. Student instruction in buttermaking was satisfactory with one to two churns per week.

Ice Cream Section.—Ice cream manufacture increased slightly and provided sufficient student training. Sales increased slightly.

Market Milk Section.—Sales increased by about 4 per cent over 1968. Practical training was reduced by the continued employment of a technical assistant. Flavoured milk production was recommenced in April, 1969.

By-Products Section.—Pasteurized skim milk supplies were satisfactory throughout the year and increased supplies are ensured for the next two years. About 2,500 gallons per week were received. An order was placed for a new roller drier. Delivery in January, 1970, is expected.

Cheese Section.—Cheddar cheese manufactured was only 36 per cent of the quantity made in the record year, 1967–68. The reduced quantities necessitated the withdrawal of sales to Government Stores Department. Almost all sales were from the factory store, at increased prices.

Skim cheese manufacture increased by some 16 per cent and augmented the practical instruction in this section.

Fancy cheese demonstrations were maintained and Edam, Swiss Roman, Blue Vein, processed, and cottage cheese were made. Yoghurts were also demonstrated to students.

Dairy Factory Statistics (with the previous year's in parenthesis).—87,000 lb butter produced (201,680 lb); 58,000 lb cheese (162,179); 300,000 lb milk from the Nepean Milk Society surplus (2,349,427); 3,361,000 lb milk pasteurised for the Board (3,288,922); 293,000 lb milk from other sources (419,424); 2,369 gal ice cream manufactured (2,252); 85,000 lb dried milk manufactured (107,307); 6,000 gal condensed milk manufactured (7,245); 4,040 x $\frac{1}{2}$ pint cartons of flavoured milk processed (920); and 130,000 gal of skim milk receivals (96,044).

Food Technology Section

Short Special Schools.—The 10th Winter School for Factory Foremen drew a record attendance of fifty. Two further short courses, conducted in May, 1969, were: a "Meat Quality Control" school, in conjunction with the Australian Meat Board, and a "Smallgoods Manufacturing" workshop, in conjunction with the Meat and Allied Trades Federation (N.S.W. Division). The maximum number of places allocated for each was quickly filled.

Factory Production Statistics.—The quantities shown are exclusive of commodities produced for educational requirements. Unit of quantity is the lb unless otherwise stated: jam, including conserves, and fruit butter, 1940; preserved fruit—canned, 4,400; fruit—dehydrated, 180; fruit pulp, 870; preserved vegetables—canned, 3,245; vegetables—dehydrated, 220; pickled vegetables (preserved in vinegar or brine, etc.), 2,105; quick frozen vegetables, 3,825; liquid products, 790 pints; miscellaneous (powders, crystals, meats, etc.), 580 lb.

WAGGA AGRICULTURAL COLLEGE

Diploma Course

Student Numbers.—The College commenced its 20th academic year (1968) with 135 students but three withdrew during the year.

The following table compares for the 5 years including 1969 the inter-year distributions of students.

	1965	1966	1967	1968	1969
First year	55	64	63	47	53
Second year	41	34	45	45	37
Third year	30	35	26	43	43
Totals	126	133	134	135	133

Diploma Examination, 1968.—Of the 43 Third Year students who attempted the 1968 Diploma examinations, 39 satisfied the requirements—although 18 of these were among 19 granted deferred examinations. Three of the four who failed are repeating Third Year in 1969. One student gained Honours Class II.

The total of Diploma holders since the inaugural Diploma year (1951) is now 442, including 36 Honours diplomates.

Second Year Examination, 1968.—Of the 45 candidates, 21 were successful without deferred examinations. Four failed and 20 were granted deferred examinations. One of the 20 withdrew before the deferred examinations and 18 of the remaining 19 succeeded. One of the failed students is repeating Second Year.

First Year Examination, 1968.—Of the 47 students enrolled, three withdrew during the year. Of the 44 candidates at the end of the year, 23 passed. Nine failed and 12 were granted deferred examinations. Ten of the 12 succeeded. One student is repeating First Year.

The 1969 Enrolments.—Fifty-two new students were enrolled, making a First Year class of 53. The Second Year class totals 37, including one repeat. The Third Year class, 43 students, includes three repeats. It is anticipated that student numbers for 1970 will once again be 133 or 134.

The Ex-Students.—The total of ex-students from March, 1949, is now 673:

W.D.A.:	442, including 36 Honours Diplomates
H.D.A.:	8, including 3 Honours Diplomates
H.D.A. (Hort.):	4, including 1 Honours Diplomate
	454, including 40 Honours Diplomates
Non-Diplomates:	219
Total:	673

Curricula and Staffing.—There was no material alteration to the curricula in 1968-69; but the Committee of Advice for the N.S.W. Institute of Rural Studies has appointed a Board of Studies and the Subject Advisory Committees to upgrade the curriculum from 1970, when the College will become a College of Advanced Education. In anticipation of this raised status, a Chief Lecturer position was established for attention to curricular developments and standards of training. Mr H. D. Orchiston was appointed to this position in December, 1968. A position of Irrigation Agronomist was also created, and Mr H. A. Fraser was appointed.

New Buildings and Equipment.—Considerable building activities were started during this financial year but no new structure was completed and handed over.

Funds from Commonwealth Grants, for Technical Training, for Advanced Education and for Library acquisitions, as well as from the normal Consolidated Revenue sources, enabled a lot of progress in acquiring books, educational films, maps and teaching-aid equipment. The teaching aids included a loop film projector and a selection of loop films, overhead projectors, 16-mm. film projectors, projectors for microscopic slides and a large number of prepared microscope slides.

Practical Training.—The decision that 2 of the required 8 weeks extra-mural training should be done in Third Year has been a success. Reports by senior students have greatly improved, reflecting their added knowledge through the Farm Management lectures and assignments.

The College acknowledges again the indebtedness to co-operating farmers. They have willingly given unreserved assistance in whole-farm, farm management studies and in general farm operations during the student tours and provided very valuable practical experience during vacations.

Third Year students gained valuable practical experience in Animal Husbandry also as Stock Attendants at the Wagga and the Sydney Shows.

Possible effect of ultimate curricula changes, on practical work at the College sections and on extra-mural training at private properties, has been under discussion.

Student Tours.—Third Year students made the annual 5-day tour of the Central Slopes, Southern Tablelands and South Coast Regions in October, 1968.

One-day short tours were curtailed because of bad weather in autumn but will be conducted in the 1969 spring. Half and 1-day visits were made to local and district properties for Farm Management Surveys and valuation exercises.

Extra-Curricular Activities.—Sporting again highlighted student extra-curricular activities. Five football XV's were entered in the Riverina Rugby Football Competition. Inter-college rifle and tennis contests were held at Dookie Agricultural College. Teams were entered in Wagga District basketball and table tennis competitions. The College Cricket XI played social matches against Hawkesbury Agricultural College. Intra-College contests were held in boxing and billiards. Athletic and Swimming Carnivals were very successful.

Other activities included Debating within the College and in the city, and First Aid classes from which twenty-four students gained the St John Ambulance Brigade Certificate.

Short-term Schools and Conferences

A Farm Management/Economics school was conducted by the Division of Marketing and Agricultural Economics. Fifty farmers and graziers attended. The 17th Annual Rural Youth School was attended by twenty-seven members from clubs widely dispersed in N.S.W. This year the theme was Beef Cattle Husbandry.

Changed System for Basic Food Supplies

Early in 1969 the College changed from the system of butchering stock and holding the meat in storage at the Municipal Abattoir, to the contract purchasing of cut meat. Also, from 1st July, 1968, the contract purchasing of pasteurized milk was introduced. This is in lieu of the supply of raw milk from the College dairy.

College, Farm, Orchard, and Livestock Sections

Farm.—Seasonal conditions were most favourable. All forms of farm production trended upwards. Cereal grain production was the highest ever recorded at the College; over 540 tons

of grain and 100 tons of hay harvested. The wheat averaged 40.8, the oats 41.9, and the barley 61.9 bushels per acre. The cereal hay and most of the cereal grain were added to the fodder reserves. Also, 190 tons of pasture hay, 60 tons of lucerne hay, and 750 tons of silage were conserved.

Production of seed wheat and barley for distribution to farmers and Agricultural Research Stations continued, and 156 bushels of wheat and 561 bushels of barley were distributed. The College is the only institution in the State producing foundation barley seed. Thirteen varieties are handled. Areas of new cross-bred types from Victoria and Western Australia have been planted for harvesting in 1969-70.

Grain storage facilities were increased by adding two silos with approximate 4,000 bushels capacity. A building with 900 square feet floor area was constructed to house the welding and steel fabrication section. New storage tanks totalling 260,000 gallons were added to the College water supply system. About 120 acres of natural pasture land were cleared of timber, and 70 acres of this cleared land was brought under cultivation. Subdivision of the College farming land was improved by another 120 chains of new fences. A further 30 chains of College roads was sealed. Purchase of a road-patrol grader enabled better maintenance of most roads and the construction of $\frac{3}{4}$ mile of new road.

Major items of equipment purchased were a rotary hoe, cultivator, haymaker, grain bin and auger, earth scoop, fire-fighting unit, and the road-patrol grader; also a 3-cwt capacity truck, and replacement of two vehicles by new models. The College now has twenty-nine working tractors. This year the British Motor Corporation supplied on loan a Nuffield 3/45 tractor, and Massey-Ferguson Ltd replaced the firm's loan tractor with a new model.

Irrigation Section.—Appointment of a full-time Irrigation Agronomist in February, 1969, has advanced the planning and development of the College irrigation unit to provide adequate student instruction.

Electric pumping from the Murrumbidgee River to a central 25 acre-foot capacity storage tank is enabling the flood irrigation of some 130 acres and spray irrigation of 35 acres. Two 5 cu sec Dethridge wheels have been installed for water measurement studies.

Redesigning of the irrigation area to permit summer row-cropping and the planting of permanent pastures, and also the planning of a comprehensive teaching and demonstration unit, for a much improved course in irrigation, are proceeding.

Investigations to locate and test a potential site for a deep bore, to augment the pumped river water for use under the expanded programme are in hand. Water Conservation and Irrigation Commission engineers are assisting.

Orchard Section.—As part of the programme for general development of the Orchard Section, renovation of the Packing Shed has started. New equipment this year for the Section comprised: gypsum blocks and salitester meter, a land grader, Tassone vine hoe, fruit grader, under-tree rotavator, bulk bin trailer, and bulk bins.

Horse Section.—At 31st May, 1969, there were 56 head (4 entires, 36 mares, 5 geldings, and 11 foals), compared with 52 a year earlier. Sales comprised a colt and a filly, each at \$600; and the transfers were 4 geldings to Trangie Agricultural Research Station. Services to privately-owned mares comprised 10 original and 5 free return services in the 1968 breeding season. These yielded \$750 for service and \$392 for agistment. Competitive exhibits at the 1969 Sydney Royal Show, although only 4 animals were shown by the College stud, won the awards for Best Arab Exhibit, Champion Stallion, Champion Mare, Best Filly under 4 years, 3 firsts, and 2 thirds.

Beef Cattle Section.—At 31st May, 1969, there were 85 head in the stud (21 bulls and 64 cows), compared with 75 a year earlier. There were also 36 head in the grade herd (fifteen steers and 21 cows), compared with 14 a year earlier. Sales comprised 3 stud bulls, for a total of \$1,200, 1 steer and 1 bull sold for slaughter, and 3 cull dairy heifers and 1 cull dairy cow; 18 Angus females were received from Trangie Agricultural Research Station for breeding purposes.

Sheep Section.—Renovation of existing sheepyards is continuing. Stock numbers have almost returned to pre-drought levels. College sheep at the 1968 Wagga Show gained 2 first, 2 second, and 3 third places, from eight entries.

Dairy Section.—Production during the 1969 autumn (including June) has been the highest for 5 years. Prevailing conditions seem likely to ensure that this level will continue through the winter and spring months. Green fodder has been available for most of the year from grazing, and during the

summer months from forage-harvested lucerne. Supplementary feeding has been at a minimum. The silos are full and unlikely to be drawn upon before 1970.

Forty-one cows completed test for an average of 8,082 lb milk, 4.9 per cent test, and 404 lb butterfat, not including the "Demonstration Herd". Notable in the latter was the production of 16,710 lb milk, 4.0 per cent test, and 670 lb butterfat by the Friesian cow "Hawkesbury Theo Belfrette II". After four completed lactations, plus 5 months of her present lactation, she has produced 69,600 lb milk and 2,727 lb butterfat.

Sales of dairy stock comprised nine stud bulls (\$1,445) and six stud females (\$670); also twenty-six head of cull cattle (and "bobby calves") (\$950). One bull was donated to the Society for Relief in India and Pakistan, and one cow was transferred to Yanco Agricultural College for demonstration purposes. Milk and cream sales, mainly to the Milk Board and surplus to the Murrumbidgee Dairy Co., are estimated to have yielded near to \$13,000.

Improvement in the Jersey herd has been notable over the last few years through greater use of the imported sire "The Mount's Orange Boy", by artificial insemination, and concentrated use of his sons in the breeding programme. The College, as usual, entered a large team of Jerseys, and some Friesians, at the Wagga Show and a smaller team at the Sydney Royal Show. Results were very pleasing at Wagga. At Sydney three minor awards were won.

Pig Section.—There were 119 head at 30 June, 1969, compared with 128 a year earlier. Pigs born during the 12 months totalled 390. In all, 109 were killed for food, 207 were sold to market, seven were sold for stud, and 76 were stillborn or had died or were destroyed.

Poultry Section.—Major developments are proceeding, to establish the Section on a commercial basis. All outdated houses are being demolished. The 1,000 bird saw-tooth cage laying shed has been birdproofed and is serviced by an automated feed cart. The brooding section has been converted to a gas-brooding system. New egg-handling equipment includes an egg grader and a drycleaning machine.

Results of a turkey stocking-rate trial conducted at the College, in conjunction with the Poultry Research Station at Seven Hills, were presented at the Australian Poultry Science Convention in May.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

This institution has two main areas of responsibility:

- (1) *Research:* primarily on matters relating to the Murrumbidgee Irrigation Areas and Coleambally Irrigation Area; and to a lesser extent matters relating to the surrounding un-irrigated areas, and the Murray Irrigation regions.
- (2) *Education:* by way of the existing one year Farm Certificate Course; and the projected 1 year Irrigation Certificate Course intended to begin in 1970.

The research work is staffed by officers of the Department's Divisions of Plant Industry, Animal Industry, Dairying, Horticulture, and Science Services, and has been incorporated within those Divisional sections of this Report of the Department for 1968-69.

Here sufficient to report that for a number of years the institution has been practising a "Programme Year" system with regard to both Station and District research and has been notable for rapid dissemination of the results of research to extension officers.

Annually, the district officers, the research officers, and the crop specialists (as observers), have met at Yanco to plan their year's activity. Originally the conference concerned rice only but has broadened to include cotton, irrigated wheat, miscellaneous crops, and weeds research. The situation and outcome are good, in that research workers are in touch with district problems; extension workers are rapidly acquainted with research results; fullest use is made of available resources; and points of co-operation are defined.

Challenges to be met in the immediate future are: the influx of nearly 300 new rice growers; decline of the canning peach industry, and, probably, increased use of herbicides on the soil.

The Farm Certificate Course

Student Numbers in 1968 and the Examinations.—The 1968 enrolment was 102 students but eleven withdrew before the final examinations. Of the ninety-one examination candidates, 60 passed without and another five with the aid of the deferred examination. The total of twenty-six unsuccessful candidates comprised the highest failure rate since this Course became available. This situation has been closely analysed for possible causes. The possible causes considered were as follows:

- (a) Possible effect of having made the Course harder and having raised the standards. Some effect is apparent. The staff are now watching this situation closely and, where needed, re-evaluating their courses. However, the top twenty students in the 1968 Course reached far higher standards than the students in any previous year. This could indicate that the Course overall academically is not too difficult.
- (b) Possible effect of a change made in the examination system: The individual subjects were grouped into four disciplines, viz., Agronomy, Animal Husbandry, Farm Management Economics and Farm Engineering. Students were assessed, not on marks gained in individual subjects, but over the whole discipline concerned. Students who failed in a particular discipline were interviewed and re-assessed. The change has been assessed as having had no effect towards the results being poor. Rather it has given the weaker student a better chance.
- (c) Possible effect of previous schooling: Most students now are products of the School Certificate (Wyndham) system of secondary education. So far the possible effect is difficult to evaluate.
- (d) Possible effect of age and maturity: Many of the students in 1968 were immature; barely 16 years of age on enrolment. This is felt to have been one of the causes.
- (e) Possible effect of lack of previous practical farming experience: Again this was felt to be a major factor. Many of the failure students had no such experience.
- (f) Possible effect of motivation: A low but significant number of the students had enrolled because of parent enforcement and, as became apparent, had little real interest in completing the Course successfully. The high number of students forced to withdraw from the College during 1968 were all in this group. They were a disturbing influence until withdrawn.

This (f) seemed to be the main factor involved in the high failure rate. A constructive thought is that if students were made to do a minimum of 12 months practical experience before enrolling at the College, many in this category would not enrol and much of this problem would be eliminated.

Student Numbers in 1969.—Enrolments for the 1969 course totalled 102. At this stage of the year, June 1969, many of the problems discussed in respect of 1968 are not apparent. No student has been asked to withdraw as a result of poor work in the First Term examinations.

About twenty of this year's intake are appreciably older than the norm. Many are paying their own way through College. These factors have had the most desirable effect of stimulating the whole group into discussion and other useful inter-reactions. Progress examination results have been much more encouraging than hitherto.

Television Film Produced.—A 15-minute film for television use was made by College staff in co-operation with the Southern Agricultural Region's Publicity Officer. The film was aimed at showing the character and objectives of the Course, and especially the types of instruction given. It has now been televised through most rural TV stations in N.S.W.

College Buildings and Amenity Improvements.—Work on a new Accommodation Block to house fifty students has commenced. This will replace older existing dormitories. Planning has commenced for a new Animal Husbandry teaching unit, involving all the livestock industries except Dairy Husbandry. The student swimming pool has been completed to Stage I. Stage II will involve obtaining the filtration unit.

The Projected Irrigation Certificate Course

Plans have been made to enable this one year Course to begin in 1970. It is additional to the 1 year Farm Certificate Course. A detailed course in all aspects of irrigation is intended.

APPENDIX I

ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1968/69

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally owned property is a charge on the General Loan Account.

In addition to the foregoing sources of funds, the Department is assisted in financing certain specified lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, semi-Governmental, and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of "Special Deposits" accounts, some details of which are given later in this Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1967-68	1968-69	Increase or decrease
	\$	\$	\$
Consolidated Revenue Fund	14,884,267	16,377,276	1,493,009 (Increase)
General Loan Account	472,347	756,148	283,801 (Increase)
	\$15,356,614	\$17,133,424	\$1,776,810 (Increase)

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

The following tabulation provides a comparison of the expenditure from Consolidated Revenue Fund by the functional Divisions of the Department for the last two financial years:

Division	1967-68	1968-69	Increase or decrease
	\$	\$	\$
Central Administration (a)	2,864,318.11	4,005,089.25	1,140,771.14 (Inc.)
Science Services	632,849.92	387,680.51	45,169.41 (Dec.)
Plant Industry	726,446.34	836,621.42	110,175.08 (Inc.)
Horticulture	769,357.03	772,882.78	3,525.75 (Inc.)
Dairying (b)	1,450,980.70	1,263,253.06	187,727.64 (Dec.)
Hawkesbury Agricultural College	681,598.76	734,834.05	53,235.29 (Inc.)
Wagga Agricultural College	423,692.92	449,202.32	25,509.40 (Inc.)
Research Stations	1,483,786.27	1,587,463.93	103,677.66 (Inc.)
Animal Industry—			
Head and District Offices	2,654,209.34	2,803,537.03	149,327.69 (Inc.)
Queensland Border	265,107.62	292,718.32	27,610.70 (Inc.)
Tick Quarantine Areas	2,429,924.58	2,466,735.20	36,810.62 (Inc.)
Royal Botanic Gardens	501,995.73	577,258.41	75,262.68 (Inc.)
	\$14,884,267.32	\$16,377,276.28	\$1,493,008.96 (Inc.)

	1967-68	1968-69
	\$	\$
(a) Includes Drought Relief Measures—Cartage on fodder, transport subsidies, &c.	135,068.41	1,019,083.65
(b) Includes Assistance to North Coast Dairying Industry	746,150.00	500,000.00
	\$881,218.41	\$1,519,083.65

The amounts provided for assistance to the North Coast Dairying Industry were carried to Special Deposits Account (No. 99) "North Coast Dairy Feed Year Assistance Scheme"; comment on which appears later in this appendix under that section dealing with Special Deposits Account.

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from the General Loan Account for the year ended 30th June, 1969, was \$756,148.42.

Details of this expenditure are as follows:

	\$
Advanced Education—	
Capital Works financed from State and Commonwealth Allocations (State contribution)	50,000.00
Division of Science Services—	
Rydalmere Plant Quarantine Station	3,619.55
Hawkesbury Agricultural College—	
School of Dairy Technology—New Research Laboratory	8,268.26
Alstonville Tropical Fruit Research Station—	
Cottage	11,850.00
Condobolin Agricultural Research Station—	
Cottage	16,000.00
Narrabri Agricultural Research Station—	
Plant Breeder's Shed (Cotton)	1,971.97
Orange Agricultural College—	
Acquisition of Property	246,341.00
Seven Hills Poultry Research Station—	
Brooder (Broiler) Houses	852.90
Laboratory and Administration Building	6,619.82
Tamworth Agricultural Research Station—	
Cottage	11,000.00
Trangie Agricultural Research Station—	
Irrigation Development—Stage 1	5,640.00
Wollongbar Agricultural Research Station—	
District Veterinary Laboratory (Far North Coast)	12,824.13
Feed Shed (Pigs)	18,346.51
Growing Shed (Pigs)	7,092.18
Glenfield Veterinary Research Station—	
Laboratory and Conference Room	352,014.15
Steam Raising Plant and Autoclaves	3,707.95
Total	<u>\$756,148.42</u>

OTHER ACCOUNTS

Special Deposits Accounts

Following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:

Name of Account	Balance as at 1st July, 1968	Receipts 1968-69	Payments 1968-69	Balance as at 30th June, 1969
	\$ Cr.	\$	\$	\$ Cr.
Advances to Officers for purchase of Motor Cars ..	Dr. 235,196.95	127,216.37	112,909.83	Dr. 220,890.41
Potato Growers' Licensing Act, 1940	819.15	3,602.56	3,200.00	1,221.71
Commonwealth/State Flood Relief Scheme, 1964 ..	50,035.34	.....	.....	50,035.34
Advanced Education—Capital Works financed from State and Commonwealth Allocations	55,093.60	138,300.00	186,500.75	6,892.85
Balance of Salaries Adjustment Suspense Account ..	280,084.88	347,178.02	280,084.88	347,178.02
Commonwealth/State Flood Relief Scheme, 1967 ..	136,365.26	.....	136,365.26	.....
Commonwealth/State Bush Fire Relief Scheme, 1968 ..	.....	196,000.00	94,703.33	101,296.67
Government Printing Office—Working Account and Stores Account and Sale of Publications .....	.....	4,441.99	190.21	4,251.78
North Coast Dairy Feed Year Assistance Scheme ..	202,863.45	500,000.00	615,649.72	87,213.73
Noxious Insects Destruction Account	65,204.68	183,980.38	10,854.72	238,330.34
Swine Compensation Fund	605,570.40	101,074.64	22,483.87	684,161.17
Treasury Fire Risks .....	.....	.....	531.52	Dr. 531.52
Commonwealth Grant—State Secondary School and Technical Training Projects financed under States' Grants (Technical Training) Act—1965	125,611.89	102,800.00	152,212.93	76,198.96
Hawkesbury Agricultural College Canning Factory Account	4,052.72	2,560.75	4,402.61	2,210.86
Bush Fire and Flood Relief Account (State)	49,787.31	25,000.00	49,000.11	25,787.20

Special Deposits Account—continued

Name of Account	Balance as at 1st July, 1968	Receipts 1968-69	Payments 1968-69	Balance as at 30th June, 1969
	\$ Cr.	\$	\$	\$ Cr.
Hawkesbury Agricultural College—Dairying Factory Working Account	80,395.74	318,874.91	313,955.05	85,315.60
Tobacco Industry Trust Account	13,208.43	60,176.52	57,484.04	15,900.91
Pasture Control Account	20,082.74	.....	.....	20,082.74
Commonwealth Government grant for acquisition of Library Materials in terms of the States' Grants (Advanced Education) Act, 1967	60.00	6,260.00	4,148.75	2,171.25
Daily Telegraph—TCN 9—Bush Fire Relief Fund ..	.....	97,962.60	83,611.63	14,350.97
French Bean Seed Marketing Board of New South Wales—Funds upon Dissolution Account	116.11	.....	.....	116.11
Potato Marketing Board of New South Wales—Funds upon Dissolution Account	232.57	.....	185.25	47.32
Unclaimed Moneys Account	1,332.76	704.44	685.22	1,351.98
Commonwealth Extension Services Grant	150,326.96	965,885.55	1,030,186.28	86,026.23
Cattle Compensation Fund	1,766,125.18	445,372.81	369,687.03	1,841,810.96
V.P. Bragg Scholarship—Wagga Agricultural College	265.17	615.00	862.48	17.69
Wagga Agricultural College Swimming Pool Account ..	1,281.00	1,498.00	1,744.77	1,034.23
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry ..	21,483.35	1,386.25	9,558.32	13,311.28
V.P. Bragg Scholarship Account (Investment)	12,000.00	.....	.....	12,000.00
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry—Investment Account	30,000.00	.....	.....	30,000.00
Sydney Farm Produce Markets Authority .....	.....	25,000.00	25,000.00	.....
Triennial Elections of Lemon Marketing Board for the State of New South Wales, 1969 .....	.....	.....	259.36	Dr. 259.36
Triennial Elections of Tobacco Leaf Marketing Board of New South Wales, 1968	Dr. 34.08	142.55	108.47	.....
Triennial Election of Producers' representatives to the Wine Grapes Marketing Board for the Shires of Leeton, Wade and Carrathool, 1968 .....	.....	.....	81.23	Dr. 81.23
Advance by U-DALS for employment of casual labour at Wollongbar Agricultural Research Station .....	.....	200.00	163.59	36.41
Advance for purchase of Peat Cultures for U-DALS ..	99.67	91.76	220.43	Dr. 29.00
Apple and Pear Spray Residue Committee—Employment of Fruit Inspector	16.63	.....	.....	16.63
Australian Cotton Research Conference .....	.....	402.00	361.00	41.00
Australian Dairy Produce Board—Grant for Research Projects—				
Composition of Milk	250.09	.....	250.09	.....
Efficiency of Detergents	629.70	.....	629.70	.....
Expansion of other Pasture and Animal Research ..	5,021.36	8,541.93	12,833.94	729.35
Farm Management Economics in North Coast Dairying .....	.....	9,350.00	2,866.75	6,483.25
Flood Irrigation Research, Mooneba	747.55	.....	175.80	571.75
Mastitis Research and Control .....	.....	1,800.00	1,502.38	297.62
Milking Machines and Mastitis	166.60	.....	166.60	.....
Pasture Improvement	614.00	4,000.00	4,614.00	.....
Pasture Species Research	6,825.51	17,289.19	17,314.24	6,800.46
Problems associated with the manufacture and keeping qualities of Process Cheese	808.51	7,223.12	5,726.70	2,304.93
Recombining Unit—Hawkesbury Agricultural College	2,486.18	687.50	322.53	2,851.15
Socio Economic Investigations	750.84	.....	750.84	.....
The influence of seasonal variations in the Compositional quality of Skim Milk on the physical and chemical qualities of Spray Dried Skim Milk Powder	1,304.64	9,555.42	11,239.86	Dr. 379.80
Australian Meat Research Committee—				
Upper River Beef Feed Year Research, North Coast ..	4,386.04	32,213.33	24,309.02	12,290.35
Major and Minor Element Deficiencies in Soil from Beef Areas	438.03	3,747.88	3,428.31	757.60
Phosphate Levels in North Coast Soils with specific relation to Summer Legumes	3,242.83	13,591.77	13,884.79	2,949.81
Winter Nutrition on Northern Tablelands	613.91	13,905.34	12,786.10	1,733.15
Nature and Organisation of the Australian Beef Cattle Industry	1,064.75	6,364.30	6,358.53	1,070.52
Beef Cattle Improvement through Breeding Methods	279.04	13,248.98	13,850.15	Dr. 322.13
Inoculants for Summer Legumes	0.20	.....	0.20	.....
Incidence, Importance and Control of Parasites of Cattle in New South Wales	2,270.11	9,252.10	8,768.72	2,753.49
Bloat Research	197.07	6,000.00	5,955.30	241.77
Sheep Fertility Service	21,105.64	19,476.33	38,291.42	2,290.55
Regional Economic Studies on Mutton and Lamb Production	1,170.02	10,249.32	4,367.70	7,051.64
The Evaluation of Selection and Management Practices in Terms of Carcase Characteristics ..	.....	2,520.00	1,970.55	549.45
Australian Potash Research Institute Grant—Investigation into Potassium Status of New South Wales Soils	100.62	.....	.....	100.62

Special Deposits Account—continued

Name of Account	Balance as at 1st July, 1968	Receipts 1968-69	Payments 1968-69	Balance as at 30th June, 1969
	\$ Cr.	\$	\$	\$ Cr.
<i>Australian Wool Board Grants—</i>				
Adaptive Pasture Research—Southern Tablelands	1,503.05	15,530.00	12,630.71	4,402.34
A Developmental Project for the High Rainfall Region of South Eastern Australia	611.46	3,660.00	4,099.81	171.65
Aerial Control of Serrated Tussock—Southern Tablelands	1,385.54	600.00	1,454.55	530.99
Aerial Sowing of Pastures	666.21	4,225.00	4,696.72	194.49
A Study of Factors limiting Pasture Yield	756.07	4,225.00	4,779.05	202.02
A Study of some Factors influencing efficiency of Root Nodule Bacteria	Dr. 715.40	7,500.00	7,328.81	Dr. 544.21
Comparison of Management Systems	Dr. 828.73	3,642.00	3,740.20	Dr. 926.93
Comparison of the Lifetime performance of Single and Twin Born Merino Ewes	332.29	1,300.00	1,492.19	140.10
Co-operative Research into Treatment of non- arable areas—Serrated Tussock Control	495.57	800.00	695.97	599.60
Development and use of various Biochemical Parameters in Diagnosis		5,177.00	996.00	4,181.00
Economic Investigation of Serrated Tussock Control	4,889.20		4,889.20	
Efficiency of Wool Production	3.80	7,317.00	5,331.68	1,989.12
Farm Management Problems of Development in the Yass Valley	2,989.28	8,540.00	11,275.26	254.02
Fleece Measurement for Selection of Stud Merino Rams	273.10	17,180.00	10,443.40	7,009.70
Fleece Measurement for Selection of Stud Merino Rams—Fees	2,820.97	3,454.14	6,016.11	259.00
Fodder Conservation—Northern Tablelands		2,520.00	2,094.88	425.12
Forage Crops—Northern Tablelands		2,520.00	2,217.14	302.86
Forage Ecology—Research Agronomists training with Division of Plant Industry—C.S.I.R.O., Canberra	5,005.73	10,000.00	14,165.56	840.17
Interactions between Species, Nutrients, Soils— Southern Tablelands		2,420.00	1,029.71	1,390.29
Investigation of Black Soil Scarab	2,587.12		2,587.12	
Pasture/Animal Production Study		2,420.00	1,935.93	484.07
Pasture Research—Cool Wet Areas—Southern Tablelands		8,690.00	5,044.82	3,645.18
Physiology of Pasture Seeds	1,184.48	3,610.00	4,607.84	186.64
Post-Graduate Scholarship—M. H. Campbell		3,378.00	3,378.00	
Post-Graduate Scholarship—R. E. Everett	0.60	200.00	200.60	
Post-Graduate Scholarship—P. H. Holst		950.00	94.00	856.00
Post-Graduate Scholarship—B. A. Hamilton		3,986.00	3,928.00	58.00
Post-Graduate Scholarship—I. D. Killeen	111.00	2,503.00	1,814.00	800.00
Post-Graduate Scholarship—G. E. Robards		2,884.00	2,884.00	
Post-Graduate Scholarship—R. J. Roughley	95.00	5,387.00	5,387.90	94.10
Post-Graduate Scholarship—A. J. Williams		2,942.00	2,825.00	117.00
Post-Partum Mating of Sheep			2,591.93	Dr. 2,591.93
Purchase of X-Ray Spectrograph and Diffracto- meter		26,000.00	10,246.37	15,753.63
Research into Control of Insecticidal Resistance in Sheep Blowfly	Dr. 1,125.09	7,750.00	6,584.32	40.59
Sheep Breeding and Pasture Management—Relative efficiency at several Stocking Rates and Super- phosphate Levels	2,826.60	14,235.00	11,100.34	5,961.26
Skin Folds and Ram Fertility	286.50			286.50
The effect of Pasture Management and time of lambling on Wool and Lamb Production in the South-West Wheat Belt of New South Wales ..	877.63	880.14	926.68	831.09
The importance of the Ram in Flock Reproductive Performance	4,218.98	3,685.00	3,484.39	4,419.59
The influence of rates of stock and superphosphate applications on the Productivity of Merino Ewes grazing improved Annual Pastures	664.82	200.00	665.60	199.22
The Productivity of Natural Annual Pastures at Trangie with and without supplementary areas of lucerne or natural perennial grasses	536.21	500.00	132.61	903.60
<i>Banana Research Committee Grant for Research—</i>				
Mixed Ripe Problem	77.30		77.30	
Packaging	186.70	300.00	5.88	480.82
Handling	124.29		124.29	
Ripening	327.57	409.39	121.73	615.23
Transport	751.37		396.06	355.31
Pre-cooling	139.02		117.61	21.41
Consumers' Preference Survey, Sydney	1,000.00		1,000.00	
Staff and Travelling	1,326.70	6,352.61	7,623.54	55.77
Board of Tick Control Employees' Proportion of Contributions to Local Government Superannuation Scheme	11,550.26	44,847.84	40,829.16	15,568.94
Brown Rot Investigations—Trust Fund	610.81		383.89	226.92
Commonwealth Contribution towards cost of Investigation into Excess Spray Residue on Fruit ..	1,763.41	1,021.73	2,785.14	

Special Deposits Account—continued

Name of Account	Balance as at 1st July, 1968	Receipts 1968-69	Payments 1968-69	Balance as at 30th June, 1969
	\$ Cr.	\$	\$	\$ Cr.
Commonwealth Grant—Milking Machine Components Testing Station	1,124.14	1,062.00	1,776.02	410.12
Contribution by Arnott's Biscuits Pty Ltd—towards Breeding of Improved Wheat Varieties in Irrigation Areas	.....	8,000.00	.....	8,000.00
Contributions by Auscott Pty Ltd for Cotton Research in the Namoi Valley	.....	1,013.24	698.20	315.04
Contribution by Australian Mushroom Growers' Association and Commonwealth for research into Mushroom Diseases	.....	6,992.00	2,240.81	4,751.19
Contribution by Australian Wool Board—Training of Livestock Research Officers	69.05	.....	7.54	61.51
Contribution by CSIRO towards Overseas Visit—D. J. McGillivray	.....	3,000.00	3,000.00	.....
Contribution by Industry towards Overseas Visit—R. J. Jessup	1,400.00	.....	1,400.00	.....
Contribution by Industry towards Research into Meatmeal quality at Seven Hills Poultry Research Station	65.82	.....	55.00	10.82
Contribution by Metropolitan Water, Sewerage and Drainage Board towards maintenance of greens, embankments, &c., Woollahra and Centennial Park Reservoirs	.....	1,000.00	1,000.00	.....
Contributions by States towards salary and expenses of Patrol Officer, Grasshopper Control	6,085.48	9,851.00	11,229.30	4,707.18
Contribution to Animal Insect Pest Investigations—Glenfield Veterinary Research Station	359.85	.....	.....	359.85
Contribution towards development of Tamworth Research Station	1,350.23	.....	.....	1,350.23
Department of Agriculture—Suspense Account	97,441.09	5,966,493.59	5,977,950.29	85,984.39
Donation by A.C.F. and Shirley Fertilizers, Ltd—Purchase of Fertilizer	.....	1,481.80	1,345.80	136.00
Donation by I.C.I.A.N.Z. towards Pasture Fertilizer Nitrogen Investigations	6.35	.....	6.35	.....
Geigy Agricultural Chemicals contribution towards Weedicide Research Project at Hawkesbury Agricultural College	200.00	.....	.....	200.00
Grant by Australian Apple and Pear Board for Co-operative Programme with CSIRO on Pest Management in Pome Fruit Orchards	1,574.50	8,845.50	5,972.24	4,447.76
Grant by Australian Honey Board for Hive Equipment for Departmental Apiaries (Operating Expenses)	506.72	.....	506.72	.....
Grant by Co-operative Bud Selection Society Limited, towards establishment of Citrus Mother Tree Block	21.83	.....	9.81	12.02
Hawkesbury Agricultural College—Egg Laying Competition Prize Fund	2,014.28	2,395.60	950.70	3,459.18
Hawkesbury Agricultural College Trust Account	7,003.30	19,790.97	13,689.18	13,105.09
McGarvie Smith Institute—Contribution towards facilities for Glenfield Veterinary Research Station	2.48	.....	2.48	.....
Manning District Agricultural Research Council—Contribution for Pasture Research in the Manning District	441.38	.....	1,148.36	Dr. 706.98
Navy Bean Marketing Board—Surplus Funds	.....	150.17	4.71	145.46
Pender W. S. Memorial Fund—Interest on Bonds	335.49	118.00	.....	453.49
Reserve Bank of Australia—Grant from Rural Credits Development Fund for Dairy Farm Development on Alluvial and Chocolate Basalt Soils in Richmond Valley	1,140.02	.....	46.40	1,093.62
Reserve Bank of Australia—Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies on Red Basalt Soils	1,024.30	.....	30.00	994.30
Scholarship—D. J. McDonald—Douglas Mackellar Memorial Award—Rice Industry Co-ordination Committee	.....	2,000.00	.....	2,000.00
Shannon Vale Nutrition Station Working Account	38,012.61	15,400.43	19,417.82	33,995.22
Skeleton Weed Research—Grant by Technical Sub-Committee for Salary of Technical Assistant	1,600.00	.....	1,508.29	91.71
South Coast Agricultural Research and Extension Council—contribution towards research	926.93	2,500.00	1,372.05	2,054.88
Sydney Farm Produce Market Authority	.....	31,223.47	31,223.47	.....
The Sulphur Institute of U.S.A.—Grant for Compilation, &c. of results of U.P.S.E.T. Trials	1,590.70	.....	.....	1,590.70
Tobacco Extension Grant to finance additional Extension Work	464.07	.....	62.91	401.16
Tropical Fruit Research Station—Donation by Banana Growers' Federation	4,228.47	.....	416.01	3,812.46
Unclaimed Salaries and Wages	1,475.77	2,145.66	1,321.14	2,300.29
Unemployment Relief in Drought Areas, 1968	7,770.05	9,304.73	16,767.15	307.63
Wagga Agricultural College Trust Account	4,490.98	6,497.82	8,219.83	2,768.97

Special Deposits Account—continued

Name of Account	Balance as at 1st July, 1968	Receipts 1968-69	Payments 1968-69	Balance as at 30th June, 1969
	\$ Cr.	\$	\$	\$ Cr.
<i>Wheat Industry Research Committee of New South Wales—Grants—</i>				
A Study of Fertilizer Nitrogen reactions in Wheat Belt Soils—Wagga		7,100.00	6,333.76	766.24
Breeding of Improved Wheat Varieties for Irrigation Areas	7,003.11		226.64	6,776.47
Contribution of Legumes to the productivity of Wheat Soils in Northern New South Wales	720.23	3,400.00	3,393.47	726.76
Controlled Environment Chamber for Frost Research	208.72		148.82	59.90
Critical Levels of Soil Nitrogen in the Southern Wheat Belt		6,800.00	5,267.77	1,532.23
Electronic Grain Counter		600.00		600.00
Extensions—Laboratories—Agricultural Research Institute, Wagga	10,000.00		3,225.92	6,774.08
Genetic Analysis of Physiological Components of Maturity of Wheat	2,899.16	2,200.00	5,355.15	Dr. 255.99
Growth, Development and Yield of Wheat Varieties in relation to date of Sowing and Environment	16,536.82	2,000.00	8,879.15	9,657.67
Investigation of Black Soil Scarab	410.89		124.76	286.13
Laboratory Equipment—Wagga Agricultural Research Institute	141.29			141.29
Pilot Regional Testing Service for Phosphorus on Wheat		2,700.00	1,443.86	1,256.14
Purchase of Solarimeter	104.20		104.20	
Skeleton Weed Research	238.33		238.33	
Soft Wheat Quality Programme—Central West ..	2,373.67		45.33	2,328.34
Soil Fertility	539.66		539.66	
Soil Factors associated with Nutrient Deficiencies in Wheat			120.67	Dr. 120.67
Travel and Capital Expenditure—Dr A. T. Pugsley and G. M. Halloran	431.38		431.38	
Wheat Breeding—Temora	400.00		400.00	
Wheat Research in the Central West	18,240.51	72,538.00	66,202.20	24,576.31
<i>Wheat Industry Research Council Grants—</i>				
Australian Wheat Collections	26,500.00	15,000.00	39,713.74	1,786.26
Capital Grant for Extensions, Agricultural Research Institute, Wagga	8,150.34		8,150.34	
Controlled Environment Facilities	10,500.00		10,500.00	
Critical Levels of Soil Nitrogen in the Southern Wheat Belt	616.02		231.08	384.94
Economics of Segregation and Storage of Wheat..	663.92		111.52	552.40
Equipping of Sub-Station for Wheat Research		4,401.00		4,401.00
Growth Analysis of Wheat in relation to development and the natural environment	586.59	3,025.17	3,169.02	442.74
Importation of Norwegian Drill and Austrian Autoheader	6,427.03		4,669.82	1,757.21
Improvement of Durum Wheat Varieties	931.24	9,179.91	8,845.08	1,266.07
Improvement of Grazing Lucerne Varieties for Wheat Belt Soils and Testing of Phalaris Strains	11,936.65	4,000.00	10,652.87	5,283.78
Investigation into possibilities of Segregation of Wheats on the basis of quality—Wheat Grading Survey	1,698.58			1,698.58
Laboratory Equipment—Agricultural Research Institute, Wagga	2,744.36		748.50	1,995.86
Manufacture of New Cereal Plot Header	189.50		189.50	
Overseas Visit (Travel)—H. Marcellos	1,805.00		834.00	971.00
Overseas Visit—A. N. Smith	658.11		658.11	
Pathology Glasshouse—Tamworth	12,000.00		12,000.00	
Scholarship—P. H. Hodge		1,950.00		1,950.00
Seed Counter for Durum Project	1,100.00			1,100.00
Senior Post-Graduate Scholarship in Agricultural Extension—R. D. Macadam	1,950.00	1,950.00	3,900.00	
The Chemistry of Soil Nitrogen in relation to Wheat Production	36.76			36.76
The use of First Generation Hybrid Seed for Commercial Wheat Production	659.58	3,154.39	357.61	3,456.36
Wheat Frost Injury—Biochemistry of Resistance Mechanisms	1,916.95	7,574.25	7,398.77	2,092.43
Yellow Dwarf Virus	160.74		160.74	
Yanco Agricultural Research Station Trust Account	10,061.44	6,122.56	4,930.28	11,253.72
Total	\$ 3,886,333.29	10,342,446.72	10,306,098.49	3,922,681.52

Commonwealth Grant for State Secondary Schools—Technical Training Projects

These funds are made available by the Commonwealth under the States' Grants (Technical Training) legislation. The grant for the first triennium, which commenced on 1st July, 1965, involved a total expenditure of \$800,000. An allocation of \$63,240 had been made during 1964-65, making \$863,240 in all.

Works to the value of \$149,277 had been completed up to 30th June, 1968. Further works were completed during 1968-69 at a cost of \$323,870. Works in progress at 30th June, 1969, and carrying over into 1969-70 are expected to absorb the remainder of the grant.

A second triennium commenced on 1st July, 1968, involving a programme of works to the value of \$1,227,000. As at 30th June, 1969, \$79,310 had been spent.

Below is a summary of receipts and expenditure in respect of this grant:

<i>First Triennium</i> (1965-66 to 1967-68)—		
Grant received from Commonwealth	\$	\$ 800,000.00
Expenditure to 30th June, 1968		674,388.11
Expenditure during 1968-69—		
Buildings—		
Hawkesbury Agricultural College—		
Science Block renovations	7,647.42	
Animal Husbandry Unit	58,009.00	
Wagga Agricultural College—		
Extensions to Graham Block	4,809.68	
Engineering and Farm Demonstration Unit	600.00	
Equipment—		
Hawkesbury Agricultural College	1,837.09	
		<u>72,903.19</u>
Balance of funds for completion of Works in Progress at 1st July, 1969		<u>747,291.30</u>
		\$52,708.70
<i>Second Triennium</i> (1968-69 to 1970-71)—		
Advances received from Commonwealth, 1968-69	\$	\$ 102,800.00
Expenditure during 1968-69—		
Hawkesbury Agricultural College—		
Meat Production Storage and Demonstration Unit	19,080.00	
Beef Cattle Section	9,720.00	
Miscellaneous Plant, Teaching Aids, &c.	7,126.57	
Harvester Feed Unit	16,575.26	
Wagga Agricultural College—		
Miscellaneous Plant and Equipment	9,705.73	
New Piggery Section	90.00	
Yanco Agricultural College—		
Accommodation Block	9,690.00	
Miscellaneous Plant, &c.	4,293.07	
General—		
Advanced Planning—Consultant's Fees	3,029.11	
		<u>79,309.74</u>
Balance of advance for Second Triennium		<u>\$23,490.26</u>

Commonwealth Grants for Colleges of Advanced Education

Commonwealth legislation provides for grants towards capital expenditure on projects for courses of instruction which comply with certain conditions laid down. The first triennium for these grants terminates on 31st December, 1969.

Only one course at Hawkesbury Agricultural College currently complies with the requirements, but it is expected that both Hawkesbury and Wagga Colleges will qualify for grants from 1st January, 1970. In the meantime, and in anticipation of both Colleges meeting the criteria by 1970, a programme of capital works has been put in hand.

Works estimated to cost \$1,422,000 were programmed for the triennium. The value of those completed at 30th June, 1968, was \$23,305, whilst works in progress are expected to absorb a further \$716,736 by the end of the triennium.

Funds are provided on a \$1 for \$1 basis by the Commonwealth and the General Loan Account of the State.

Expenditure on the programme during 1968-69 is summarized below:

<i>Hawkesbury Agricultural College—</i>	\$	\$
Erection of Poultry Section	625.00	
Equipment for Cannery	1,908.15	
Laboratory and Lecture Room for Dairy Technology Course	48,315.54	
Residential accommodation	5,034.26	
		<u>55,882.95</u>
<i>Wagga Agricultural College—</i>		
Augmented Water Supply	9,351.38	
Developmental Plant	800.00	
Dining Room and Kitchen	24,900.00	
Equipment and Furniture	7,818.10	
Residential Accommodation	82,217.88	
Sports Facilities	5,530.44	
		<u>130,617.80</u>
Total Expenditure 1968-69		<u>\$186,500.75</u>

Swine Compensation Fund

A summary of the operations on the fund is set out hereunder:

	\$	\$	\$
Balance as at 1st July, 1968			605,570.40
Receipts—Stamp Duty			101,074.64
			706,645.04
Payments—Swine Compensation		15,685.27	
Administration Costs		6,798.60	
			22,483.87
Balance as at 30th June, 1969			\$684,161.17

Cattle Compensation Fund

	\$	\$	\$
Balance as at 1st July, 1968			1,766,125.18
Add Receipts—			
Levy		213,078.58	
Stamp Duty		138,794.23	
Interest		93,500.00	
			445,372.81
			2,211,497.99
Deduct Payments—			
Compensation		356,082.41	
Administrative Costs—			
Allowances to Secretaries of Pastures Protection Boards	5,326.00		
Department of Agriculture	8,278.62		
		13,604.62	
			369,687.03
Balance as at 30th June, 1969			\$1,841,810.96

The following statistical information is furnished in connection with the payment of cattle compensation amounting to \$356,082.41:

Disease	Claims			Animals			Payments		
	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total
							\$	\$	\$
Tuberculosis	351	130	481	1,010	169	1,179	36,373.36	13,098.09	49,471.45
Cancer	4,102	228	4,330	5,593	286	5,879	184,111.34	17,535.21	201,646.55
Actinomycosis	2,155	13	2,168	2,534	13	2,547	81,579.80	574.55	82,154.35
Actinobacillosis	624	11	635	781	11	792	20,817.88	756.27	21,574.15
Pleuro pneumonia contagiosa ..	2	..	2	2	..	2	190.00	..	190.00
Trichomoniasis	2	..	2	14	..	14	456.48	..	456.48
Tick Fever	4	..	4	14	..	14	322.91	..	322.91
John's Disease	4	..	4	4	..	4	266.52	..	266.52
Totals	7,244	382	7,626	9,952	479	10,431	324,118.29	31,964.12	356,082.41

Commonwealth Extension Services Grant

Commonwealth grants for extension were amalgamated under one heading—"Commonwealth Extension Services Grant". The first allocation under the amalgamated system was made in 1966-67, when an assurance was given that such grants would continue for 5 years, that is until 1971-72.

Expenditure since the commencement of the amalgamated grant is summarized below:

Item	1966-67	1967-68	1968-69	Total
	\$	\$	\$	\$
Research Officers	3,861.61	37,810.06	65,074.86	106,746.53
Extension Officers	106.42	121,576.47	156,271.81	277,954.70
Field Assistants	..	98,682.94	109,152.82	207,835.76
Inspectors and Laboratory Assistants	833.49	37,386.09	46,742.05	84,961.63
Equipment for Officers	24,817.25	57,048.83	217,664.54	299,530.62
Motor Vehicles	4,719.55	32,334.56	69,100.00	106,154.11
Buildings	28,525.00	30,810.04	103,829.40	163,164.44
Materials for Demonstrations	212.68	12,409.34	23,850.38	36,472.40
Extension Aids	11,786.37	22,604.59	31,239.19	65,630.15
Publications and Books	12,123.25	41,575.18	31,503.69	85,202.12
Conferences and Study Tours—				
Overseas	28,566.08	66,942.02	24,572.01	181,264.92
Australia	..	76,617.99	61,184.81	
Grade Herd Recording	..	..	71,200.00	147,817.99
Totals	\$115,551.70	\$635,798.11	\$1,011,385.56	\$1,762,735.37

In addition to the above expenditure, the following amounts were financed from the "Sale of Assets" Account during 1968-69:

Publications—\$13,320.00. Motor Vehicle—\$5,480.72.

Noxious Insects Destruction Account

The Noxious Insects Act, 1934, provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into Special Deposits Account and applied by the Minister for the purposes of the Act.

Following is a Statement of Receipts and Payments during 1968-69:

RECEIPTS		PAYMENTS	
	\$		\$
Balance as at 1st July, 1968	65,204.68	Contribution to Australian Locust Patrol Service	5,950.00
Levies	183,160.38	Holden Station Sedan	1,534.30
Proceeds Sale of Motor Vehicle	820.00	Aircraft Hire	740.33
		Radio Transceivers (4)	1,224.00
		Materials and Sundry Purchases	1,406.09
		Balance as at 30th June, 1969	238,330.34
	<u>\$249,185.06</u>		<u>\$249,185.06</u>

Potato Growers' Licensing Act, 1940

The Act was amended in October, 1968, to provide for the licence fee to be prescribed by regulation. Subsequently the fee was raised to \$4.00 per annum, in lieu of the previous charge of \$2.00 per annum, from 28th February, 1969. Furthermore, the amended Act provides for the cost of administration to be levied on the basis of 10 per cent of the total sum paid to the credit of the account during the preceding period of 12 months.

Following is a Statement of Receipts and Payments during 1968-69:

RECEIPTS		PAYMENTS	
	\$		\$
Balance as at 1st July, 1968	819.15	Grants to Potato Growers' Association	3,200.00
Licence Fees	3,602.56	Balance as at 30th June, 1969	1,221.71
	<u>\$4,421.71</u>		<u>\$4,421.71</u>

Shannon Vale Nutrition Station—Working Account

Following is a statement of Receipts and Payments for the year ended 30th June, 1969:

RECEIPTS		PAYMENTS	
	\$		\$
Balance as at 1st July, 1968	38,012.61	Wages	4,770.61
Sale of Wool	11,671.54	Shearing	1,123.47
Sale of Sheep and Skins	3,521.39	Motor and Tractor Fuel	289.21
Rental of Cottage	207.50	Vaccines and Drenches	845.94
		Purchase of Motor Vehicle	1,555.87
		Fodder	1,131.92
		Seeds and Fertilizers	992.07
		Freight and Cartage	453.82
		Workers' Compensation Insurance	82.66
		Payroll Tax	159.87
		Insurances on Vehicles	87.87
		Purchase of Sheep	3,250.00
		Repairs to Plant and Equipment	298.88
		Purchase of Equipment	717.03
		Electricity	307.13
		Fencing and Water Supply	1,884.47
		General Stores	1,467.00
	<u>\$53,413.04</u>	Balance as at 30th June, 1969	33,995.22
			<u>\$53,413.04</u>

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR 1968-69

Head of Receipt	Net Receipts	
	\$	\$
Receipts for Services Rendered—		
Agricultural Colleges and Farms—		
Rents	65,196.95	
Students' Fees	189,709.89	
		254,906.84
Fees—		
Jurors' Fees	28.10	
Witness' Expenses	54.61	
Examination Fees	45.00	
Apiary Registrations	5,141.37	
Grading—Dairy Industry Act	75.67	
Registration—Dairy Industry Act	129.00	
Dairy Science Schools	1,137.35	
Farm Produce Agents' Act	578.00	
Fertilizer Act	1,829.10	
Pest Destroyers Act	3,556.30	
Registration of Stock Brands	6,532.41	
Registration of Swine Brands	482.00	
Stock Foods and Medicines Act	8,513.90	
Veterinary Surgeons' Act	3,414.11	
		31,516.92
Contributions—		
Commonwealth Government—		
Administration of Plant Quarantine	219,089.08	
Administration of Animal Quarantine	112,284.48	
Administration of Commerce Act	77,995.04	
Maintenance of Gardens at Admiralty House	14,264.53	
Milk Board of New South Wales—		
T.B. Testing in Dairy Herds	597.19	
		424,230.32
Miscellaneous Services Rendered—		
Plant Diseases Act—Inspection and Fumigation Fees	858.70	
Meat Industry Act—Meat Inspection Fees	921,602.29	
Commonwealth Scientific and Industrial Research Organization—Subsidy of Vegetable Growing at Hawkesbury Agricultural College	1,000.00	
Herd Recording Fees	237,176.07	
Seed Testing and Certification Fees	25,467.58	
Administration of Cattle Compensation Fund	8,278.62	
Administration of Swine Compensation Fund	6,798.60	
Commission for Collection of Premiums	5,719.58	
Other Miscellaneous Receipts	75,332.16	
		1,282,233.60
Total—Receipts for Services Rendered		\$1,992,887.68
General Miscellaneous Receipts—		
Rents exclusive of Land	12,026.50	
Fines and Forfeitures	14,339.57	
Sale of Farm Produce	360,099.67	
Sale of Government Property	8,403.28	
Commonwealth Government Contribution for Cattle Tick Control	310,000.00	
Repayment to credit of Consolidated Revenue Fund—Previous Years	170,743.86	
Transfers of Part Balances not required	362.29	
Broadcasting Fees	66.00	
Gas and Electricity	9,725.01	
Postages	257.59	
Telephone Calls (private)	4,625.96	
3 per cent contribution—Pastures Protection Boards	71,527.12	
Employer's Liability to State Superannuation Fund	96.41	
Commonwealth Grant towards cost of Herd Recording	71,200.00	
Commonwealth Contribution under States' Grants (Advanced Education) Act	26,760.00	
Other Miscellaneous Receipts	60.96	
Total—General Miscellaneous Receipts		1,060,294.22
Grand Total—All Revenue		\$3,053,181.90

MISCELLANEOUS ACCOUNTS

Veterinary Surgeons' Act, 1923 (as amended)

The Act provides for the establishment of the Board of Veterinary Surgeons of New South Wales. Fees and penalties collected under the Act are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Board are met.

As at 30th June, 1969, there were 755 registered Veterinary Surgeons.

Following is a Statement of Receipts and Payments for the year ended 30th June, 1969:

RECEIPTS		PAYMENTS	
	\$		\$
Registration Fees	207.00	Salaries	1,673.00
Roll Fees	3,198.71	Members' Fees	871.20
Restoration Fees	8.40	Travelling Expenses	61.58
		Postal Expenses	180.60
		Printing	303.03
		Minor Expenses	13.58
		Excess of Receipts over Payments	311.12
	<u>\$3,414.11</u>		<u>\$3,414.11</u>

Meat Inspection Service

The Meat Inspection Service is administered by virtue of the Meat Industry Act, 1915, which makes provision for a scale of inspection fees. The fees were increased by 50 per cent as from 7th March, 1969.

Following is a Statement of Receipts and Payments in connection with the service for the twelve months ended 30th June, 1969:

RECEIPTS		PAYMENTS	
	\$		\$
Inspection Fees—		Salaries and Wages	891,254.22
Regulation 7	123,851.28	Temporary Assistance	10,217.39
Regulation 8	82,392.67	Allowances	493.71
Regulation 9	216,058.05	Retirement Leave	8,527.14
Regulation 9B	435,953.41	Overtime	13,030.22
Regulation 10	63,346.88	Metropolitan Meat Industry Board—Endowment Fund contribution	5,272.52
		Tea Money	27.40
		Rent	1,640.00
		Travelling	54,202.04
		Motor Vehicle Running Costs	458.64
		Freight and Cartage	204.85
		Postal and Telephone Expenses	1,096.16
		Books and Periodicals	153.23
		Fees for Services Rendered	349.70
		General Stores	4,036.06
		Gas and Electricity	107.95
		Printing	729.94
Excess of Payments over Receipts	70,198.88		
	<u>\$991,801.17</u>		<u>\$991,801.17</u>

In addition to the deficiency of \$70,198.88 shown above, overhead expenses of \$182,900.37 should be taken into account. These include Employer's Superannuation, Workers' Compensation Insurance, and Payroll tax, calculated at 20 per cent of the cost of salaries, wages, and overtime (\$914,501.83). This increases the deficiency to \$253,099.25 (\$395,388.66 in 1967–68). It is expected that the effect of the increased fees for the full year in 1969–70 will eliminate this deficiency.

Fund Created by the Wheat Marketing (Barring of Claims) Act, 1929 (as amended)

REVENUE ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1969

	\$		\$
To Commitments Account	3,941.82	By Interest on Investments	5,212.34
To Accumulated Funds Account	1,270.52	(including Savings Bank Interest)	
	<u>\$5,212.34</u>		<u>\$5,212.34</u>

BALANCE SHEET AS AT 30TH JUNE, 1969

LIABILITIES		ASSETS	
	\$		\$
Accumulated Funds—		Investments in Government Securities (at face value)	100,000.00
Balance as at 1st July, 1968....	101,934.15	Commonwealth Savings Bank	6,607.89
Net Surplus for the year ended 30th June, 1969.....	1,270.52	Interest accrued to 30th June, 1969	1,031.91
	<u>103,204.67</u>		
Commitments as at 30th June, 1969	4,435.13		
	<u>\$107,639.80</u>		<u>\$107,639.80</u>

Dairy Products Factory—Hawkesbury Agricultural College

The operations of the Dairy Products Factory for the financial year 1968-69 resulted in a net loss of \$41,931.71. The loss for the previous financial year was \$27,449.64. The main reason attributed to this increased loss is the adverse seasonal conditions which reduced the amount of surplus milk available. The amount of surplus milk available was further reduced by an increase in consumption of Milk Board milk. The surplus milk intake in 1966-67 of 3,681,582 lb was reduced to 712,178 lb in 1968-69.

Following are the abridged accounts for 1968-69:

MANUFACTURING AND TRADING ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1969

	\$		\$
Stock on hand at 1st July, 1968.....	10,641.27	Sales	303,117.18
Purchases	241,936.25	Stock on hand at 30th June, 1969	10,828.02
Repairs and Maintenance	7,816.97	Gross Loss	9,794.13
Fuel, Light, and Power	5,469.78		
Water	2,500.71		
Salaries and Wages	26,245.28		
Workers' Compensation Insurance	307.19		
Payroll Tax	655.01		
Superannuation—Employer's Liability	2,563.53		
Depreciation	25,295.75		
Sundry Expenditure	307.59		
	<u>\$323,739.33</u>		<u>\$323,739.33</u>

PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1969

	\$		\$
Gross Loss from Trading Account	9,794.13	Sundry Income	126.94
Salaries and Wages	9,707.41		
Payroll Tax	242.28		
Workers' Compensation Insurance	113.63		
Superannuation—Employer's Liability	435.59		
Levies—Butter and Cheese	467.30		
Freight and Cartage	245.35		
Laboratory Expenses	506.45		
Repairs and Maintenance	102.03		
Telephone	353.68		
Depreciation	1,503.43		
General Expenses	233.47		
Printing and Stationery	577.30		
Interest on Capital	17,776.60	Net Loss for 1968-69	41,931.71
	<u>\$42,058.65</u>		<u>\$42,058.65</u>

APPROPRIATION ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1969

	\$		\$
Net Loss—1968-69	41,931.71	Balance at 1st July, 1968	23,442.95
Balance as at 30th June, 1969	2,979.51	Expenditure not met from Working Account ..	21,293.27
		Adjustment—Step-up—1967-68	175.00
	<u>\$44,911.22</u>		<u>\$44,911.22</u>

APPENDIX II

PUBLISHED MATTER*, 1968-69

*Viz.:—Matter printed as Department of Agriculture (D. of A.) booklets, or contributed to or printed as articles either in Department of Agriculture journals (the monthly *Agricultural Gazette of N.S.W.*, the quarterly *Review of Marketing and Agricultural Economics*, bi-monthly *Dairy Topics*, monthly *Poultry Notes*, quarterly *Veterinary Notes*) or the journals of other institutions/organizations; papers presented at technical conferences for which there are published records; and theses presented for higher degrees.

The Appendix does not list the many times greater volume of items contributed in the course of extension work through such channels as the Department's *Press Releases*, and the Regional/District publicity releases for newspapers, radio stations, and primary producers. Indications of the volume of this published matter are included in this report under "Division of Information Services" and "Division of Extension Services".

RESEARCH STATIONS BRANCH

D. of A. Booklet

Drever, J. G. J. (1968)—A report on a tour of some agricultural engineering establishments in Canada, the United States of America, and the United Kingdom, 1967.

Contributions to Journals

Finlayson, W. H. (1968)—Rice headers inadequate for tough harvest. *Power Farming and Better Farming Digest*. 77 (10): 14–15.

Finlayson, W. H. (1968)—Harvesting lodged crops. *I.R.E.C. Farmers Newsletter Large Area Edition No. 68*: 10–14.

Holligan, P. J. (1968)—Maintenance of orchard sprayers. *Central Coast Research and Extension Committee Rural Newsletter No. 15*: 1–2.

Lackie, D. A. and Holligan, P. J. (1968)—Grain storage and handling. *Power Farming and Better Farming Digest*. 77 (10): 8–10.

Other Publications

Whiston, W. D. (1968)—Australian national machinery field days programme and catalogue of farm machinery. *Central Western Dairy Print* (pub.).

DIVISION OF PLANT INDUSTRY

D. of A. Booklets

Anon. (1968)—Beetroot: a popular salad vegetable. *Bull. P.* 17.

Anon. (1969)—Brussels Sprouts. *Bull. P.* 13.

Anon. (1968)—Carrots: a profitable crop. *Bull. P.* 16.

Anon. (1969)—Growing artichokes. *Bull. P.* 9.

Anon. (1969)—Lettuce growing. *Bull. P.* 24.

Anon. (1968)—Tomato culture under glass. *Bull. P.* 44.

Anon. (1969)—Turnips and swedes for fodder. *Bull. P.* 95.

D. of A. Leaflets

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, North Western Agricultural Region.

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, Northern Agricultural Region.

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, Western Agricultural Region.

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, Mid-Western Agricultural Region.

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, Southern Agricultural Region.

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, South Western Agricultural Region (dryland).

Fitzsimmons, R. W. (1968)—Wheat varieties for 1969, South Western Agricultural Region (irrigation).

Johnson, R. I. and Holland, J. (1969)—Grain sorghum yield trial results, 1965–67.

Johnson, R. I. and Launders, T. E. (1969)—Forage sorghum yield trial results, 1961–67.

Contributions to Journals

Anon. (1969)—Carrots—a profitable crop. *Agric. Gaz. N.S.W.* 80 (4): 216–9.

Anon. (1969)—Galvanized burr and its control. *Agric. Gaz. N.S.W.* 80 (4): 223.

Anon. (1969)—The sweet potato. *Agric. Gaz. N.S.W.* 80 (5): 284–8.

Bagshaw, F. A. (1968)—The dahlia. *Agric. Gaz. N.S.W.* 79 (11): 669–75.

Boyle, A. J. (1969)—Aerial topdressing in the upper Hunter. *Agric. Gaz. N.S.W.* 80 (5): 264–71.

Boyle, J. W. and Johnson, R. I. (1968)—Calculating maize plant populations for bigger yields. *Agric. Gaz. N.S.W.* 79 (7): 410–11.

Boyle, J. W. and Johnson, R. I. (1968)—Pearl millet—new summer forage crops in New South Wales. *Agric. Gaz. N.S.W.* 79 (9): 513–15.

Boerema, E. (1968)—The long grain breeding programme at Yanco. *Rice Mill News*.

Campbell, M. H. (1968)—Established growth and survival of six pasture species surface sown on unploughed land infested with serrated tussock (*Nassella trichotoma*). *Aust. J. exp. Agric. Anim. Husb.* 8 (33): 470–7.

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Dann, P. R. (1968)—Effect of clipping of wheat. *Aust. J. exp. Agric. Anim. Husb.* 8 (35): 731–5.

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Doyle, A. D. (1968)—Controlling weeds in tobacco with Benefin. *Agric. Gaz. N.S.W.* 79 (8): 456–9.

Doyle, A. D. (1969)—Chemical control of weeds in tobacco. *Aust. J. exp. Agric. Anim. Husb.* 9 (36): 12–18.

Fitzsimmons, R. W. (1968)—Disease and frost damage to cereal crops in the 1967–68 season. *Agric. Gaz. N.S.W.* 79 (10): 575–8.

Hindle, J. (1969)—Mobile maize detasselling for hybrid seed. *Agric. Gaz. N.S.W.* 80 (1): 12–14.

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Mears, P. T. (1968)—Plant nutrition research—beef cattle pasture of northern New South Wales. *Trop. Grasslds.* 2 (1): 84–92.

Noonan, J. B. (1969)—Health to pasture on the Mid North Coast. *Dairy Topics*. 14 (1): 14–16.

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Peart, G. R., and Scott, R. C. (1969)—Sowing methods for establishment of dryland lucerne. *Agric. Gaz. N.S.W.* 80 (2): 66–70.

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DIVISION OF DAIRYING

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Anon. (1968)—Determination of fat content of milk by "Milk-O-Tester" method.

Contributions to Journals

Anon. (1969)—New building for dairy research at Hawkesbury. *Agric. Gaz. N.S.W.* 80 (1): 48.

Anon. (1968)—Effect of gain in weight, height and girth in dairy calves on future production. *Agric. Gaz. N.S.W.* 79 (7): 375.

Auld, R. L. (1968)—Two-system identification of dairy cattle. *Dairy Topics* 13 (5): 21-3.

Boutcher, L. G. (1969)—Choked squeeze action on pulsators. *Dairy Topics* 14 (1): 19-20.

Boutcher, L. G. (1969)—Milking performance and shed management. *Dairy Topics* 14 (2): 3-5.

Boutcher, L. G. (1969)—Faulty releaser action. *Dairy Topics* 14 (2): 6-7.

Calder, B. O. E. (1969)—Modern milking management. *Dairy Topics* 14 (2): 2-35.

Curtin, W. T. (1968)—To make a simple water filtration unit. *Dairy Topics* 13 (6): 16-18.

Curtin, W. T. (1969)—Effective hinges for a backing gate. *Dairy Topics* 14 (1): 17-18.

Dowling, J. F. (1968)—Stainless steel deserves special care. *Dairy Topics* 13 (4): 12-13.

Dowling, J. F. (1968)—The dry period and lactation. *Dairy Topics* 13 (5): 10-11.

Hrdina, F. (1968)—The repeatability of records. *Dairy Topics* 13 (4): 6.

Hrdina, F. (1968)—The effect on S.N.F. of calving interval and length of the dry period. *Dairy Topics* 13 (5): 11.

Hrdina, F. (1968)—The effect of age at first calving on subsequent milk quality and production. *Dairy Topics* 13 (6): 18.

Laffan, R. T. (1969)—Sediment test standards for raw milk. *Dairy Topics* 14 (2): 16-17.

Logue, I. J. (1969)—Mastitis and a new herringbone shed. *Dairy Topics* 14 (2): 18.

Rathore, A. K. (1969)—Milk and 4 per cent F.C.M. of dairy cattle for 1968 herd year. *Agric. Gaz. N.S.W.* 80 (2): 122.

Rathore, A. K. (1969)—Size of the herd and its influence on milk production. *Agric. Gaz. N.S.W.* 80 (3): 184.

Rathore, A. K. (1969)—Milk production: nature and nurture. *Dairy Topics* 14 (1): 8-9.

Rathore, A. K. (1969)—Goats—milk production, and the effect of age on milk quality. *Dairy Topics* 14 (2): 19-22.

Richards, A. O. (1968)—Trends in shed design and management. *Dairy Topics* 13 (5): 12-17.

Scott, D. R., and Rathore, A. K. (1969)—Beat the solids-not-fat problem. *Dairy Topics* 14 (2): 14-15.

Sjostedt, J. P. (1968)—Small farm economics. *Dairy Topics* 13 (4): 3-5.

Sjostedt, J. P. (1968)—Zero grazing. *Dairy Topics* 13 (5): 5-9.

Stewart, B. A. (1969)—Thermophilic bacteria scourge of dairy products. *Dairy Topics* 14 (1): 21-2.

Stewart, B. A. (1968)—Do your cans pass muster? *Dairy Topics* 14 (2): 13.

Ware, B. H. (1968)—What is the value of a good cow family? *Dairy Topics* 13 (5): 18-20.

Wilson, J. S. (1969)—Herd recording creates a ready calf market. *Dairy Topics* 14 (1): 6-7.

Wreford, R. G. (1968)—Artificial insemination—a worthwhile investment. *I.R.E.C. Farmers' Newsletter Large Area Edition* No. 64.

Contributions to Technical Conferences

Calder, B. O. E. (1968)—Defects in current installations. Proc. 4th Aust. Machine Milking School and Conference: 41–50.

Calder, B. O. E. (1968)—N.S.W. summary of defects in current installations. Proc. 4th Aust. Machine Milking School and Conference: 58–62.

Calder, B. O. E., and Ahern, K. E. (1968)—Field experience of cleaning systems—results of N.S.W. survey. Proc. 4th Aust. Machine Milking School and Conference: 122–5.

Dunsmore, D. C. (1968)—Principles of detergency. Proc. 4th Aust. Machine Milking School and Conference: 93–7.

DIVISION OF SCIENCE SERVICES

(i) BIOLOGY BRANCH

Contributions to Journals

Anon. (1968)—Peach rosette in the M.I.A. Agric. Gaz. N.S.W. 79 (8): 606.

Anon. (1968)—Powdery mildew of ornamentals. Agric. Gaz. N.S.W. 79 (8): 622–4.

Anon. (1968)—Dexon controls post-emergence damping-off in vetch. Agric. Gaz. N.S.W. 79 (12): 747.

Anon. (1969)—A virus disease of cultivated mushroom in New South Wales. Agric. Gaz. N.S.W. 80 (1): 52.

Anon. (1969)—A cure for crown gall. Agric. Gaz. N.S.W. 80 (1): 48.

Anon. (1969)—Organic matter and humus in relation to soil fertility. Agric. Gaz. N.S.W. 80 (2): 106–13.

Anon. (1969)—Wood rot of fruit trees. Agric. Gaz. N.S.W. 80 (4): 208–12.

Anon. (1969)—Interceptions in plant quarantine for the year ended 30th June, 1968. Agric. Gaz. N.S.W. 80 (4): 243.

Anon. (1969)—Peach rosette and decline. Agric. Gaz. N.S.W. 80 (5): 309.

Ballantyne, Barbara (1968)—Stem and root diseases of beans. Agric. Gaz. N.S.W. 79 (8): 463–8.

Ballantyne, Barbara (1968)—Summer death—a new disease of beans. Agric. Gaz. N.S.W. 79 (8): 486–9.

Ballantyne, Barbara (1969)—Transmission of summer death of beans. Aust. J. Sci. 31 (12): 433–4.

Bertus, A. L. (1968)—*Phytophthora cinnamomi* Rands on conifers in New South Wales. Agric. Gaz. N.S.W. 79 (12): 751–4.

Conroy, R. J. (1969)—Bacterial wilt or brown rot of potatoes. Agric. Gaz. N.S.W. 80 (3): 175–8.

Hamill, P. M. (1968)—Care and propagation of starter cultures for cultured milk products. Aust. J. Dairy Technol. 23 (3): 142.

Kable, P. F., and Parker, K. G. (1968)—Cherry viruses transmitted to milkweed from infected peach and kwanzan cherry. Phytopathology 58:1443–4.

Kable, P. F. (1968)—Brown rot of stone fruits on the Murrumbidgee Irrigation Areas. I. Etiology of the disease in canning peaches. Aust. J. Agric. Res. 20 (2): 301–16.

Kable, P. F. (1968)—Brown rot of stone fruits on the Murrumbidgee Irrigation Areas. II. Etiology of the disease in Trevett apricot trees. Aust. J. Agric. Res. 20 (2): 317–23.

Kiely, T. B. (1968)—Fungicidal sprays and their influence on disease, quality and blemish in valencia oranges at Mangrove Mountain. Agric. Gaz. N.S.W. 79 (10): 613–20.

McLeod, R. W. (1968)—The effects of *Aphelenchoides saprophilus*, *A. coffeae*, *Aphelenchus avenae* and *Panagrolaimus* sp. on the cropping of cultivated mushrooms. Nematologia 14: 573–6.

Taylor, R. H. (Vic. D. of A.), and Pares, R. D. (1968)—The relationship between sugar cane mosaic virus and mosaic viruses of maize and Johnson grass in Australia. Aust. J. Agric. Res. 19 (5): 767–73.

Walker, J., Kable, P. F., Smith, A. M., McDonald, D. J., and Boerema, E. B. (1968)—*Cochliobolus sativus* (Ito and Kuribay) Drechs. ex. Dastur causing a leaf spot on rice in New South Wales. Aust. J. Sci. 31 (2): 82.

Walker, J., and McLeod, R. W. (1969)—New records of plant diseases in New South Wales. Agric. Gaz. N.S.W. 80 (4): 237–42.

Contributions to Technical Conferences

Fraser, L. R., Long, K., and Cox, J. (1968)—Stem-pitting of grapefruit—field protection by the use of mild virus strains. Proc. 4th Conf. Int. Organization of Citrus Virol. Univ. Florida Press (pub): 27–31.

Kable, P. F. (1968)—Short-, medium-, and long-range dispersal of pathogens and virus vectors. In Prevalence of virus vectors and airborne diseases. CSIRO Melbourne (pub): 19–31.

Post-Graduate Thesis

Robinson, A. C. (1968)—Factors influencing the efficiency of root-nodule bacteria. (A study of the effectiveness of naturally occurring strains of *Rhizobium trifolii*; the comparative ecology of *R. trifolii* and *R. meliloti*; and competition for nodulation between effective and ineffective strains of *R. trifolii*). M.Sc. Thesis Aust. Nat. Univ.

Other Publications

Kable, P. F. (1968)—Report on research conducted by New South Wales Department of Agriculture on brown rot of stone fruits during the period 1957–63. In Report of the research work on brown rot of stone fruits conducted under the auspices of the Brown Rot Research Committee 1957–62. Government Printer, Melbourne (pub): 97–103.

DIVISION OF SCIENCE SERVICES

(ii) CHEMISTRY BRANCH

D. of A. Booklet

Chatfield, M. G. (1969)—Report on overseas consultations on water for stock and irrigation and soil-water-plant relationships.

Contributions to Journals

Anon. (1969)—Citrus leaf analysis—effect on leaf type and standards. Agric. Gaz. N.S.W. 80 (3): 182.

Anon. (1969)—New method for measuring rain damage to wheat. Agric. Gaz. N.S.W. 80 (4): 235.

Barnes, W. C. (1968)—The use of the flour maltose value as a measure of starch damage, and alpha amylase activity. J. Aust. Inst. agric. Sci. 34 (3): 183–5.

Dakternieks, Harris, C. M., Morris B. (all Univ. N.S.W.), Milham, P. J., and Sinn, E. (Univ. N.S.W.) (1969)—Magnetism and structure of polymeric oxo-vanadium IV complexes. Inorg. Nucl. Chem. Lett. 5:97–100.

Harris, C. M., Janes, J. M. (both Univ. N.S.W.), Milham, P. J., and Sinn, E. (Univ. N.S.W.) (1969)—Metal complexes as ligands. VIII. Copper bromide complexes with bidentate Schiff bases. Inorg. Chem. Acta.

Helyar, K. R. (1969)—Differences between subterranean clover and lucerne on acid soils. Agric. Gaz. N.S.W. 80 (6): 378–9.

O'Neill, D. K., and Hebden, S. P. (1968)—Investigation of sheep dips. III. The influence of breed on stripping and deposition in the fleece of diazinon. Aust. vet. J. 44 (7): 344–9.

Contributions to Technical Conferences

Chatfield, M. G. (1969)—Salinity and nutrition problems in the nursery. N.S.W. Assoc. of Nurserymen's Seminar: 7–10.

Chatfield, M. G. (1969)—Water movement in soil. N.S.W. Assoc. of Nurserymen's Seminar: 11–12.

Milham, P. J., and Paull, R. (1969)—The feasibility of a petiole nitrate test as a guide in predicting the nitrogen fertilizer requirements of irrigated cotton. Working papers 1st Aust. Cotton Res. Conf.: 2.17–21.

Van Dijk, D. C. (CSIRO), Riddler, A. M. H., and Rowe, R. K. (Vic. Soil Con. Authority) (1968)—Criteria and problems in ground surface correlations with reference to a regional correlation in south-eastern Australia. Trans. 9th Int. Cong. Soil Sci. 4: 103–14.

Other Publications

Old, A. N. (1968)—The Wianamatta Shale waters of the Sydney district—their salinity and a suggested geological explanation. Dept Mines Booklet.

DIVISION OF SCIENCE SERVICES

(iii) ENTOMOLOGY BRANCH

D. of A. Booklets

Jones, E. L., Kable, P. F., Duncan, J. H., Forsyth, J. B. (1968)—The Murrumbidgee Irrigation Areas orchard spray calendar, 10th edition.

Contributions to Journals

Anon. (1969)—The painted apple moth. Agric. Gaz. N.S.W. 80 (5): 304.

Anon. (1969)—Mealybugs. Agric. Gaz. N.S.W. 80 (4): 220–2.

Casimir, M. (1968)—Control of grasshoppers (*Phaulacridium vittatum*) by ultra-low volume aerial application of technical maldison. Aust. J. exp. Agric. Anim. Husb. 8 (34): 631–6.

Gellatley, J. G. (1969)—The broad mite *Hemitarsonemus latus* (Banks) (Acarina: Tarsonemidae). Agric. Gaz. N.S.W. 80 (2): 96–7.

Greening, H. G. (1968)—Prevention is better than cure—protecting the coming wheat harvest. Agric. Gaz. N.S.W. 79 (9): 506–12.

Jones, E. L. (1968)—Bloodworms—pests of rice. Agric. Gaz. N.S.W. 79 (8): 477–8.

Jones, E. L. (1968)—*Chironomus tepperi* Skuse (Diptera: Chironomidae) as a pest of rice in New South Wales. Aust. J. Sci. 31 (2): 89.

Other Publications

Geier, P. W. (CSIRO), Harris, W. B. (S.A.D. of A.), Hillman, T. J. (CSIRO), Hudson, N. M. (Tas. D. of A.), Jones, E. L., Lloyd, N. C., Lower, H. F. (S.A. D. of A.), Morris, D. S. (Vic. D. of A.), and Webster, W. J. (Vic. D. of A.) (1969)—A co-operative programme of research into the management of pest insects in pome fruit orchards of south-eastern Australia: A progress report for 1966–67. Technical Papers Series, Division of Entomology, CSIRO.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

Contribution to Journal

Briggs, B. G., and Ehrendorfer, F. (Univ. Graz, Austria) (1968)—New combinations in *Parahebe* (Scrophulariaceae). Taxon. 17: 742.

Contribution to Technical Conference

Johnson, L. A. S. (1968)—Rainbow's end: the quest for an optimal taxonomy. (Presidential Address.) Proc. Linn. Soc. N.S.W. 93 (1): 8–45.

For publications produced by the Royal Botanic Gardens and National Herbarium see this report under "Royal Botanic Gardens and National Herbarium".

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

(i) AGRICULTURAL RESEARCH INSTITUTE

WAGGA WAGGA

D. of A. Booklet

Mengersen, F. and Fitzsimmons, R. W. (1968)—Identification of oat varieties in New South Wales. Sci. Bull. No. 79.

Contributions to Journals

Cuthbertson, E. G. (1969)—*Chondrilla juncea* in Australia. II. Preplanting weed control and wheat production. Aust. J. exp. Agric. Anim. Husb. 9 (36): 27–36.

Kuiper, J. (1968)—Field evaluation of a derivative of 1,4-Oxathiin for control of cereal smuts. Aust. J. exp. Agric. Anim. Husb. 8 (35): 757–61.

Kuiper, J. (1969)—Failure of methoxymurcuric silicate plus malathion or lindane to control common bunt of wheat. Neth. J. Pl. Path. 75: 129–32.

Smith, A. N. (1968)—The uptake of phosphorus by wheat and clover from four inorganic soil phosphate fractions after the addition of contrasting types of phosphatic fertilizers. Pl. Soil 29: 144–55.

Smith, A. N. (1968)—Phosphorus supply in the soil from four fertilizers. Agric. Digest. 14: 3–8.

Smith, A. N. (1969)—Effects of daylength and time of application of phosphorus on growth and grain yield of wheat. Physiologia Pl. 22: 371–8.

Smith, A. N. (1969)—Growth of wheat and changes in phosphorus availability in a waterlogged soil. Agrochimica. 13: 235–42.

Smith, A. N., and Spence, T. B. (1969)—Phosphate fertilizer studies in the southern wheat belt. Results from the trials. Agric. Gaz. N.S.W. 80 (5): 291–2.

Smith, A. N., and Spence, T. B. (1969)—Phosphate fertilizer studies in the southern wheat belt. Results in three climatic zones. Agric. Gaz. N.S.W. 80 (5): 293–4.

Storrier, R. R. (1969)—Nitrogen fertilizer and wheat production in southern New South Wales. Agric. Gaz. N.S.W. 80 (2): 76–8.

Syme, J. R., and Bremner, P. M. (CSIRO) (1969)—Growth and yield of pure and mixed crops of oats and barley. J. appl. Ecol. 5: 659–74.

Syme, J. R. (1968)—Lodging in wheat and its control by (2-chloroethyl) trimethylammonium chloride (CCC) in solid form. Aust. J. exp. Agric. Anim. Husb. 8 (34): 574–7.

Syme, J. R. (1968)—Ear emergence of Australian, Mexican and European wheats in relation to time of sowing and their response to vernalization and day-length. Aust. J. exp. Agric. Anim. Husb. 8 (34): 578–81.

Contributions to Technical Conferences

Halloran, G. M. (1968)—Wheat collecting expedition to Afghanistan. Proc. 3rd Int. Wheat Genetics Symp.: 159–60.

Pugsley, A. T. (1968)—Genetic studies of phasic development and their application to wheat breeding. Proc. 3rd Int. Wheat Genetics Symp.: 288–93.

(ii) AGRICULTURAL RESEARCH STATION, TAMWORTH

Contributions to Journals

Evans, G. (1968)—Infection of *Xanthium pungens* by seed-borne *Verticillium dahliae*. Pl. Dis. Rptr. 52: 976–8.

Evans, G. (1968)—Some new hosts for *Verticillium nigrescens*. Pl. Dis. Rptr. 52: 904.

Contributions to Technical Conferences

Evans, G. (1969)—The potential of crop rotations for controlling *Verticillium* wilt of cotton. Working papers 1st Aust. Cotton Res. Conf.: 4.3–4.

Evans, G., and Paull, R. E. (1969)—*Verticillium* wilt of cotton: a serious introduced disease in the Namoi Valley. Working papers 1st Aust. Cotton Res. Conf.: 4.5–6.

Single, W. V. (1969)—Variation in resistance to spring frost in *Triticum aestivum* and related species. Proc. 3rd Int. Wheat Genetics Symp.: 282–7.

Thompson, J. A. (1968)—Studies of problems of field nodulation in Uruguay. Proc. 4th Latin-American Conf. on Legume Inoculants.

Thompson, J. A., Bathvany, C., Labandera, C., and Jaureche, C. (1968)—Sobrevivencia de *Rhizobium* en inoculantes comerciales Uruguayos. (Survival of *Rhizobium* in Uruguayan commercial inoculants.) Proc. 4th Latin-American Conf. on Legume Inoculants.

(iii) AGRICULTURAL RESEARCH STATION, WOLLONGBAR

Staff under the direction of the Director of Research, Agricultural Research Station, Wollongbar are positioned at this Station by various Divisions of the Department. Therefore, their publications are listed elsewhere in this Appendix, under the appropriate Divisional heading. (Division of Plant Industry, Division of Animal Industry, Division of Science Services, or Division of Marketing and Agricultural Economics as the case may be.)

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

D. of A. Booklets

Bird, J. G. (1968)—Alternatives in dairy industry adjustment in the far north coast area of New South Wales. Misc. Bull. 6*.

Ryan, J. G. (1968)—Economics of development of large area farms on the Coleambally Irrigation Area. Misc. Bull. 5*.

Contributions to Journals

Drane, F. H. (1969)—Partial budgeting for increases in herd size on north coast dairy farms. Dairy Topics. 14 (2): 8-12.

Elston, J. W. (1968)—Poultry farm management for profitable egg production. Agric. Gaz. N.S.W. 79 (8): 469-71.

Freebairn, J. W. (1968)—Competitive behaviour in the international wheat market. Rev. Mktg. agric. Econ. 36 (3): 111-24.*

Freebairn, J. W. (1968)—Wheat export prospects. Agric. Gaz. N.S.W. 80 (3): 149-53.

Mason, G., and Bird, J. G. (1969)—Spray irrigation on dairy farms. Farm Policy. 8 (4): 119-23.

Mason, G. (1968)—North coast irrigation profits are tied to management level. Dairy Topics. 13 (6): 8-12.

* Produced by Division of Marketing and Agricultural Economics.

Phillips, J. (1968)—An economic evaluation of contract marketing. Rev. Mktg. agric. Econ. 36 (4): 155-64.*

Contributions to Technical Conferences

Maccallum, D. E. (1968)—Data gaps in farm level soil erosion control: an economist's view. In Soil Conservation. Dept of Univ. Extension, Univ. New England (pub.): 81-3.

Maccallum, D. E. (1969)—Credit and adjustment problems. In Problems of Change in Australian Agriculture. Dept Univ. Extension, Univ. New England (pub.): 240-2.

Maccallum, D. E. (1969)—Agricultural adjustment aspects of land tenure and land development. In Problems of Change in Australian Agriculture. Dept Univ. Extension, Univ. New England (pub.): 243-6.

Standen, B. J. (1969)—The conflict between the papers by McKay and Davidson. In Problems of Change in Australian Agriculture. Dept of Univ. Extension, Univ. New England (pub.): 153-60.

* Produced by Division of Marketing and Agricultural Economics.

DIVISION OF EXTENSION SERVICES

Contributions to Journals

Lees, F. (1969)—Rice hulls in concrete. I.R.E.C. Farmers' Newsletter, Large Area No. 68: 27.

Other Publications

Edwards, L. S. (1968)—Education and professional improvement of Illinois Extension Advisers as related to their use of mass media. Univ. Illinois Bull.

HAWKESBURY AGRICULTURAL COLLEGE

Contribution to Technical Conference

Braithwaite, B. M. (1969)—A review of banana pests. Working Papers Pacific-Asian Banana Culture Interchange.

APPENDIX III

NOTES FROM

A. THE LEGAL OFFICER. B. THE CHIEF BIOMETRICIAN. C. THE SENIOR CLERK (CENTRAL ADMINISTRATION)

APPENDIX IIIA

NOTES FROM LEGAL OFFICER

Acts

Legal Branch was involved in the work leading to passage of the following Acts by Parliament: Cattle Compensation (Amendment) Act, 1968; Potato Growers' Licensing (Amendment) Act, 1968; Wheat Industry Stabilisation Act, 1968; Meat Industry (Amendment) Act, 1968; Veterinary Surgeons (Amendment) Act, 1969; Milk (Amendment) Act, 1969; Aerial Spraying Act, 1969; Banana Industry Act, 1969; Poultry Processing Act, 1969; and Horticultural Stock and Nurseries Act, 1969.

Regulations, Proclamations, Notifications

Legal Branch was involved in the work leading to gazettals of 30 Regulations, 86 Proclamations, and 35 Notifications.

Prosecutions

One hundred and fifty-five informations were prepared by Legal Branch for prosecutions for offences under the various Acts administered by the Department.

Arbitration under Agricultural Holdings Act, 1941

Three matters were referred to arbitration. In one case the matter was withdrawn from arbitration at the last minute. In another case a landlord sought an award that a tenant

was not cultivating a holding according to the rules of good husbandry. The Committee found in favour of the tenant. In the third case a landlord claimed compensation for deterioration of a holding because of the tenant's failure to cultivate according to the contract of tenancy. The Committee found in this case that notice had not been served as required by the Act, and did not make an award.

Registrations

Registrations effected during 1967-68 and 1968-69 are compared numerically hereunder:

	1967-68	1968-69
Farm produce agents	293	292
Veterinary surgeons	686	755

The Veterinary Surgeons Board met on fourteen occasions this year.

APPENDIX IIIB

NOTES FROM THE BIOMETRICAL BRANCH

Staff Developments

Mr E. A. Roberts took up duties as Chief Biometrician on 30th September, 1968, in the position vacated by retirement of Mr F. C. McCleery in May, 1968. Mr P. Lind, trainee in mathematics, completed his studies and took up duty as Biometrician on 25th February, 1969. Miss B. Davies, Mr A. Gleeson, and Mr G. O'Neill were appointed Biometrician and commenced duties on 3rd February, 1969, 3rd March, 1969, and 30th June, 1969, respectively.

General

The staff of this Branch are consulted by and advise other research workers in the Department on the design, analysis, and interpretation of experiments, and on sampling and survey

methods, and other statistical and mathematical problems. At the start of an investigation the biometrician helps to clarify and define objectives, to select the precise questions for which answers are to be sought and to decide the plans and procedures to be followed. On completion of the experimental work he does the appropriate statistical analysis, advises on interpretation of the results and may assist preparation of material for publication.

The volumes of consultant work on design of experiments, and of computing work in the analysis of results, continued to increase. This was in line with increases in research establishment throughout the Department. There has been further progress in the writing of computer programmes. These have permitted more thorough examination of data; at the same time a speedier turn-around and the handling of greater volumes of work.

Research Stations have been regularly visited, to give consultation. This important activity will grow as a result of staff increases.

Punchcard Section

This section is concerned with punching data into cards for input to computers. It relates to Dairy Herd Recording records, computer programmes (biometrical, economic, and data processing) and research data for statistical analysis.

APPENDIX IIIC

STAFF AND PERSONNEL BRANCH NOTES, FROM THE SENIOR CLERK (CENTRAL ADMINISTRATION)

Staff Section

Salary Agreements, Determinations, Awards Processed

Nine new salary agreements, four new awards, and one salary determination were processed.

Staff Numbers

The Departmental establishment for officers, employees, and trainees at 30th June, 1969, may be summarized thus:

Professional Officers	820	
Administrative and Clerical Officers	543	
General Division, and Ministerial Staffs	2,280	
Subtotal		3,643
University and College trainees, including intake for 1970	285	
Grand total		3,928

During the year, 120 positions were created: 52 in the Professional and 68 in the General Division. The total of Administrative and Clerical Division positions was reduced by one. Actually, in the Clerical Division, four positions were created, but three positions were deleted and two positions were transferred to the General Division; hence the net loss of one by it.

Four Ministerial positions were brought under section 44, Public Service Act.

Senior Positions Created

In Division of Extension Services, two: Principal Extension Officer (Extension Research/Evaluation) and Assistant Principal Extension Officer (Tamworth).

In Division of Marketing and Agricultural Economics, two: Principal Extension Economist and Principal Research Economist.

In Division of Science Services, one: Administrative Officer.

In Division of Horticulture, one: Assistant Principal Fruit Officer (Research).

In Division of Dairying, one new and four reclassified at higher status: the new position, Assistant Principal Dairy Officer (Extension); the reclassifieds, Assistant Principal Dairy Officer (Butter), Assistant Principal Dairy Officer (Other Products), Assistant Principal Dairy Officer (Research) at Hawkesbury Agricultural College, and Assistant Principal Dairy Officer (Herd Improvement).

At Hawkesbury Agricultural College, six: Chief Lecturer (Agriculture)—by deleting the former Deputy Principal position, Chief Lecturer (Food Technology), Chief Lecturer (Dairy Technology), Executive Officer, Chief Lecturer (Rural Extension), Senior Lecturer (Poultry Technology).

At Wagga Agricultural College, one: Chief Lecturer.

At Research Stations, one: Manager, Agricultural Research Station, Orange.

Promotions/Appointments of Senior Officers

Promotions/appointments comprised the following, tabulated alphabetically: Mr R. L. R. Auld, Assistant Principal Dairy Officer; Mr P. A. Baumgartner, Chief Lecturer (Food Technology), Hawkesbury Agricultural College; Mr B. W. Bootes, Assistant Principal Veterinary Officer (Meat Inspection Service); Mr L. G. Boucher, Assistant Principal Dairy Officer (Extension); Mr J. W. Boyle, Principal Agronomist (Maize); Mr B. M. Braithwaite, Chief Lecturer (Agriculture), Hawkesbury Agricultural College; Mr P. Brydon, Principal Veterinary Officer (Meat Inspection Service); Mr B. O. E. Calder, Assistant Principal Dairy Officer; Mr B. K. Compton, Special Economist (Crop Forecasting); Mr G. A. Crawford, Principal Agronomist (Miscellaneous Crops); Mr R. D. Eastoe, Principal Livestock Officer (Sheep and Wool); Mr A. C. Godlee, Senior Livestock Officer (Sheep and Wool); Mr K. R. Green, Principal Agronomist (Research); Dr S. G. Grimmer, Director of Research, Wollongbar Agricultural Research Station; Mr A. B. Hermann, Senior Clerk (Administration); Mr K. E. Hutton, Research Co-ordinator; Mr J. E. Jessup, Executive Assistant to Deputy Director-General (R.E.); Mr L. R. Kavanagh, Deputy Chief, Division of Plant Industry; Mr G. E. Kent, Assistant Principal Dairy Officer; Mr M. J. R. MacKellar, Assistant Principal Extension Officer (Group Extension); Mr D. E. Maccallum, Principal Extension Economist; Mr J. J. McCormick, Assistant Secretary; Mr F. W. Marriner, Chief Lecturer, Dairy Technology; Mr J. J. Mannion, Administrative Officer, Division of Science Services; Mr B. P. Mullins, Assistant Principal Dairy Officer; Mr H. D. Orchiston, Chief, Lecturer, Wagga Agricultural College; Mr A. C. Orman, Chief, Division of Plant Industry; Dr R. J. Richards, Bacteriologist, Special Grade; Mr H. E. Silversides, Principal Dairy Officer; Mr J. W. Strang, Principal Agronomist (Weeds); Mr R. W. Sweedman, Assistant Principal Fruit Officer; Mr D. E. Wallin, Principal Agronomist (Irrigation).

Special Reclassifications, within Public Service Board Research Scientist Establishment

Dr Mary D. Tindale, Special Botanist, National Herbarium, as Senior Research Scientist; Dr Barbara G. Briggs, Botanist, National Herbarium as Research Scientist; Dr G. Evans, Senior Research Officer, Tamworth Agricultural Research Station as Research Scientist; Mr J. Walker, Special Plant Pathologist, Division of Science Services, as Research Scientist.

Retirements

Mr G. Amendolia, Gardener, Royal Botanic Gardens; Miss D. Cohen, Clerk, Legal Branch; Mr R. S. J. Costelloe, Regional Publicity Officer; Mr R. C. Cramp, Principal Veterinary Officer, Meat Inspection Service; Mr H. Goldsmith, Cattle Inspector; Mr J. G. Jeater, Fruit Officer; Mr W. H. G. Pogendorf, Chief, Division of Plant Industry; Mr C. J. T. Hawkins, Principal Livestock Officer (Sheep and Wool).

Deaths

Mr F. T. E. Bulmer, Herd Recorder; Mr F. A. C. Gibson, Entomologist; Mr M. Marks, Laboratory Attendant; Mr F. Masters, Field Assistant; Mr A. C. Rankin, Field Assistant.

Officers Officially Overseas for Post-graduate Studies or Special Purposes

The following professional officers were, and in the majority of cases are still overseas: I. K. Hotson, Special Veterinary Research Officer, from April, 1969, to September-October, 1969, for post-graduate study and investigations of Parasitology in U.K., Europe, U.S.A.; Dr D. J. McGillivray, Botanist, 15th December, 1968, to 31st March, 1970, as Botanical Liaison Officer, Kew Gardens, U.K.; I. A. Vimpany, Chemist, from 18th May, 1969, to 19th August, 1969, to visit soil testing institutions in New Zealand, U.S.A., U.K., Europe; J. Nolan, Livestock Officer (Research), 4 years, August, 1965, to August, 1969, post-graduate studies in entomology, Cornell University, U.S.A.; R. J. Roughley, Bacteriologist, 3 years, August, 1966, to July, 1968, studying for Ph.D. at the University of London,

U.K.; *H. Marcellos*, Research Officer, 3 years, September, 1967, to August, 1970, studying for Ph.D. at the Illinois State University, U.S.A.; *D. R. Leece*, Chemist, 3 years, September, 1967, to August, 1970, on a Research Assistantship at the Michigan State University, U.S.A.; *B. J. McDonald*, Research Officer, 3 years, September, 1967, to August, 1970, post-graduate study at the Texas A. & M. University, U.S.A.; *B. R. Wilson*, Livestock Research Officer, studying for Ph.D. at the University of Alberta, Canada; *J. W. Freebairn*, Economics Research Officer, 3 years, September, 1968, to September, 1971, studying for Ph.D. at the University of California, U.S.A.

Officers at Universities within Australia for Post-graduate Studies

The following professional officers were, and in the majority of cases are still at Universities within Australia—working towards higher degrees in subject matter areas appropriate to the Department's responsibilities: *M. H. Campbell*, Agronomist, 3 years, from January, 1968, on Wool Board Scholarship, for studies towards Ph.D. at the University of New England; *N. L. Wade*, Fruit Officer, 3 years, from January, 1967, to December, 1969, on a Commonwealth Post-graduate Scholarship at the University of Sydney; *T. S. Abbott*, Chemist, 3 years, from 5th February, 1967, to January 1970, on Commonwealth Research Studentship at the University of Sydney; *P. A. McInnes*, Livestock Research Officer, 2 years, from March, 1967, to March, 1970, studying for Ph.D. at the University of Western Australia; *G. P. Gard*, Veterinary Officer, 3 years, from June, 1967, to May, 1970, studying for Ph.D. at the Australian National University; *E. M. Matheson*, Senior Research Officer, 3 years, from June, 1967, to June, 1970, holding a temporary lectureship during post-graduate studies at the University of New England; *I. D. Killeen*, Livestock Research Officer, 2 years, from February, 1966, to January, 1968, extended one year to 1969, on a Wool Board Scholarship for studies towards M.Sc. at University of Sydney; *A. J. Williams*, Wool Biologist, 3 years, from April, 1966, to April, 1969, studying towards Ph.D. at University of New England; *G. E. Robards*, Livestock Officer (Research), 2 years, from January, 1968, to January, 1970, studying towards Ph.D. at University of Melbourne; *B. A. Hamilton*, Livestock Research Officer, 2 years, from September, 1967, to August, 1969, studying towards Ph.D. at University of New England; *L. A. Hilton*, Soil Chemist, 2 years, from March, 1968, to March, 1970, holding a Research Assistantship whilst studying towards M.Sc. at University of Sydney; *J. K. Robson*, Agronomist, from March, 1969, to November, 1969, on Post-graduate Scholarship at University of Melbourne for Diploma in Rural Extension; *R. L. Colman*, Research Agronomist, 3 years, from March, 1967, to February, 1970, on Post-graduate Scholarship towards Ph.D. at University of New England; *P. J. Holst*, Livestock Research Officer, 2 years, from 1st February, 1969, for post-graduate training at the School of Biological Science, Macquarie University; *P. H. Hodge*, Agronomist, from 22nd February, 1969, to 5th December, 1969, awarded Post-Graduate Scholarship in Agricultural Extension at University of Queensland; *A. D. Clift*, Entomologist, 3 years, from 10th March, 1969, on a Commonwealth Research Studentship towards Ph.D. at University of Sydney; *P. J. Milham*, Chemist, from June, 1969, for up to five years for Ph.D. studies at Macquarie University; *P. T. Mears*, Agronomy (Research Officer), from June, 1969, for studies towards a Ph.D. at University of Queensland; *L. C. Pryde*, Livestock Officer (Sheep and Wool), from March, 1969, awarded Traineeship in Veterinary Science at University of Sydney; *W. Rohan-Jones*, Livestock Research Officer, from 9th February, 1969, for 3 years for a biological study of drought- and supplementary-feeding of sheep at University of New England.

Personnel Section

Induction Activities

Induction Check List.—The check list introduced last year for use by officers participating at various stages in the induction of new staff who pass through head office has been proven worthwhile. Only through pressure of other needs, a check list appropriate for appointees recruited *directly* to country locations has not yet been formulated.

Induction Interviews.—The total of induction interviews within Personnel Section continued to increase, in part because the induction check list has ensured the occurrence of "follow-up" interviews.

Induction Courses.—Forty-seven newly-appointed University trainees took part in a one-day Induction course, in Sydney, early in 1969. Because of College term commitments, seventeen new trainees at Agricultural Colleges could not attend it but were made familiar with the appropriate matters during later discussions—at their College.

Staff Assessment, Reporting and Guidance Scheme

This Scheme was extended to cover officers up to and including Grade 4 in the Administrative and Clerical Division. The Scheme now embraces about 450 officers and employees. Since inception last year, more than 600 reports have been received.

Counselling and Other Associated Matters

Many cases and inquiries involving study conditions, exit interviews, late arrivals, excessive sick leave, grievances, and counselling were dealt with. The statistics are later in this report. The "Staff Assessment, Reporting and Guidance Scheme" increased the total of cases requiring counselling.

Employment and Recruitment Matters

Employment Inquiries.—There was considerable increase in inquiries concerning Department of Agriculture employment; and many of the inquiries came from overseas or were by persons newly arrived in Australia. Many of the latter were referred to this Department by the Department of Immigration and/or the Department of Labour and National Service.

Careers Exhibition and Careers Nights.—The Personnel Section collaborated with other Departments to provide a Public Service Exhibit in a Careers Exhibition at Sydney Town Hall in August/September, 1968. Personnel Section officers also addressed a number of Careers Nights—at various metropolitan high schools.

Careers Booklet.—For Public Service Board and Departmental purposes, the booklet "Professional Careers in the Department of Agriculture" was revised substantially to cover more comprehensively the duties of the various occupations.

University and Agricultural College Trainees

Trainee Numbers.—There are now 195 Departmental trainees at the various Universities and Agricultural Colleges, involving sixteen degree or diploma courses. Seven of the 195 are repeating an academic year at their own expense. Sixty-eight of the 195 trainees were recruited at the start of 1969.

Selection of Trainees.—For many years trainees in Agricultural Science and in certain other faculties were selected without necessarily associating the individual with a particular Division wherein he/she could be employed on graduation. Such association awaited the nearing of completion of the course. For a 2-year trial period from the start of 1969 the Public Service Board has agreed to the recruited trainee being allotted to a particular Division.

Trainee Manual.—The Manual for University and Agricultural College trainees was revised substantially. The contents are in a more logical sequence, facilitating reference.

Safety

An intra-Departmental Safety Committee has been established, comprising representatives from various Divisions—with the Assistant Secretary as Chairman and the Personnel Officer as Secretary and Executive Officer. The Committee arranged, throughout the Department, the nomination of Safety Supervisors required to report occurrence of accidents and initiate preventive measures against recurrence. Helped by Department of Labour and Industry, the Committee arranged also that a number of Accident-Prevention Courses for appropriate officers be conducted throughout the State; also a publicity campaign to bring to all employees' notice the need for safety on the job.

Work Volume Statistics for Personnel Section

The considerable increase in Personnel Section work is to some extent illustrated by the comparative figures for 1967–68 and 1968–69, as follows:

	1967–68	1968–69
Employment correspondence; letters written	190	372
Employment interviews and inquiries:		
• interviews	161	300
• by telephone	146	422
Induction interviews	215	233
Exit interviews	—	19
Interviews or discussions re lateness, excessive sick leave, counselling and grievances:		
• interviews	—	192
• telephone discussions	—	71
Study inquiries:		
• in person	—	76
• by telephone	—	103

